R.E. Society's

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

Syllabus for

T.Y.B.Sc.

(Chemistry)

Semester V & VI

Under Choice Based Credit System (CBCS)

With effect from Academic Year- 2023-2024

Name of Programme	**B.Sc.**
Level	UG
No of Semesters	06
Year of Implementation	**2023-24**
Programme Specific Outcomes (PSO)	Upon completion of this programme students will be able to • Understand the fundamental concepts of theoretical and experimental aspects of physical, organic, inorganic, analytical and allied chemistry subjects. • Explain and clarify the understanding of thermodynamic, spectroscopic, kinetic and quantum models, stereochemistry and mechanism of organic reactions, chemical bonding and structure elucidation, analytical techniques and solving numerical problems. • Correlate and apply the theoretical chemistry knowledge in explaining practical schemes • Solve numerical problems, mechanisms, analytical interpretation using chemistry concepts and knowledge. • Interpret spectroscopic data to identify basic organic compounds • Analyse chemical species qualitatively and quantitatively using appropriate analytical techniques. • Understand and explain the processes needed in domain related industries and write their general aspects. • Apply information related to material safety data sheets (MSDS) needed in various industries. • Adopt reduce, recycle and restore chemicals (3R‟s) approach and gain the sense of ethical, social and environmental awareness and responsibility.
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	• Graduates with strong chemical knowledge and laboratory skills can support industries, research institutions, and local communities in solving local environmental issues, water purification, waste management, and sustainable resource utilization. • Chemistry graduates can foster economic growth by driving innovation and entrepreneurship. They can contribute to regional research and development initiatives, enhance product quality, and support industries in adopting green practices. Additionally, their expertise in chemical safety and ethics can promote responsible industrial practices and environmental protection, benefiting the region. • A skilled chemistry workforce is essential for the development of key sectors like pharmaceuticals, agriculture, energy, and materials. Graduates can participate in groundbreaking research, contributing to advancements that positively impact society's well-being. Their knowledge of interdisciplinary connections can aid in addressing national challenges, such as climate change, health issues, and sustainable development.

Revised Scheme of Examination
Faculty of Science
(Under-graduate Programmes)
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	One Periodical Class Test / Written objectives / Assignments/ Short answer Questions / Seminar to be conducted in the given semester	30
02	Active participation in routine class instructional deliveries and overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	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 04 questions each of 12 marks on each unit and one question of 12 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	0 (Outstanding)
8.00 ≤ 9.00	80.0 ≤ 90.0	A+ (Excellent)
7.00 ≤ 8.00	70.0 ≤ 80.0	A (Very Good)
6.00 ≤ 7.00	60.0 ≤ 70.0	B+ (Good)
5.50 ≤ 6.00	55.0 ≤ 60.0	B (Above Average)
5.00 ≤ 5.50	50.0 ≤ 55.0	C (Average)
4.00 ≤ 5.00	40.0 ≤ 50.0	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

Third Year B.Sc. (CBCS)
Course Structure

Course Code	Semester V	Credits	Course Code	Semester VI	Credits
USCH501	Physical Chemistry	**02**	USCH601	Physical Chemistry	**02**
USCH502	Inorganic Chemistry	**02**	USCH601	Inorganic Chemistry	**02**
USCH503	Organic Chemistry	**02**	USCH601	Organic Chemistry	**02**
USCH504	Analytical Chemistry	**02**	USCH601	Analytical Chemistry	**02**
USCHP501	Physical Chemistry Practical	**02**	USCHP601	Physical Chemistry Practical	**02**
USCHP502	Inorganic Chemistry Practical	**02**	USCHP602	Inorganic Chemistry Practical	**02**
USCHP503	Organic Chemistry Practical	**02**	USCHP603	Organic Chemistry Practical	**02**
USCHP504	Analytical Chemistry Practical	**02**	USCHP604	Analytical Chemistry Practical	**02**
USACDD501	Drugs and Dyes	**02**	USACDD601	Drugs and Dyes	**02**
USACDD5P1	Drugs and Dyes Practical	**02**	USACDD6P2	The Regional Case-Study Project	**02**

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

Name of the Course	B.Sc.
Course Code	**USCH501**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	-------

Course Code: USCH501

Nomenclature: Physical Chemistry

Course Outcomes: On completing the course, the student will be able to:

CO1 Comprehend the fundamentals of rotational, vibrational spectroscopy.
CO2 understand principles of Raman spectroscopy and its nature,
CO3 Apply Raoult‟s Law and Clapeyron Equation to study Colligative Properties
CO4 Analyse colligative properties of solutions and correlate these with molar masses of The solutes.
CO5 Understand reaction dynamics.
CO6 Apply collision theory to study reactions
CO7 Differentiate between physical and chemical adsorption; correlate adsorption results on The basis of various adsorption isotherm.

CO8 Correlate adsorption results on the basis of various adsorption isotherms.
CO9 Describe nuclear chemistry concepts of radioactive decay, radioactivity, fission process fusion process.
CO10 Discuss application of radioisotopes as a tracer, Q value of nuclear reaction, Types of reactor.
CO11 Illustrate the principle and working of detectors used for detection and measurement of nuclear radiations.

Curriculum:

Unit	Title	Learning Points	No of Lectures
Unit-I	**1.0 MOLECULAR SPECTROSCOPY**	**1.1 Rotational Spectrum**: Introduction to dipole moment, polarization of a bond, bond moment, molecular structure, Rotational spectrum of a diatomic molecule, rigid rotor, moment of inertia, energy levels, conditions for obtaining pure rotational spectrum, selection rule, nature of spectrum, determination of internuclear distance and isotopic shift. **1.2 Vibrational spectrum**: Vibrational motion, degrees of freedom, modes of vibration, vibrational spectrum of a diatomic molecule, simple harmonic oscillator, energy levels, zero point energy, conditions for obtaining vibrational spectrum, selection rule, nature of spectrum. **1.3 Vibrational-Rotational spectrum of diatomic molecule**: energy levels, selection rule, nature of spectrum, P and R branch lines. Anharmonic oscillator - energy levels, selection rule, fundamental band, overtones. Application of vibrational-rotational spectrum in determination of force constant and its significance. Infrared spectra of simple molecules like H_2O and CO_2. **1.4 Raman Spectroscopy :** Scattering of electromagnetic radiation, Rayleigh scattering, Raman scattering, nature of Raman spectrum, Stoke's lines, anti-Stoke's lines, Raman shift, quantum theory of Raman spectrum, comparative study of IR and Raman spectra, rule of mutual exclusion- CO_2 molecule.	**15L**
Unit-II	**2.0 CHEMICAL THERMODYNAMICS**	**2.1.1 Colligative properties:** Vapour pressure and relative lowering of vapour pressure. Measurement of lowering of vapour pressure - Static and Dynamic method. **2.1.2 Solutions of Solid in Liquid:** 2.1.2.1. Elevation in boiling point of a solution, thermodynamic derivation relating elevation in boiling point of the solution and molar mass of non-volatile solute. 2.1.2.2. Depression in freezing point of a solution, thermodynamic derivation relating the depression in the freezing point of a solution and the molar mass of the non-volatile solute. Beckmann Method and Rast Method. **2.1.3 Osmotic Pressure:** Introduction, thermodynamic derivation of Van't Hoff	**10L**

	2.2 CHEMICAL KINETICS	equation, Van't Hoff Factor. Measurement of Osmotic Pressure - Berkeley and Hartley's Method, Reverse Osmosis. **2.2.1 Collision theory of reaction rates:** Application of collision theory to 1. Unimolecular reaction Lindemann theory and 2. Bimolecular reaction. (derivation expected for both) 2.2.2 Classification of reactions as slow, fast and ultra -fast. Study of kinetics of fast reactions by Stop flow method and Flash photolysis (No derivation expected).	**5L**
Unit-III	**3.0 NUCLEAR CHEMISTRY**	3.1. **Introduction**: **B**asic terms-radioactive constants (decay constant, half-life and average life) and units of radioactivity 3.2 **Detection and Measurement of Radioactivity:** Types and characteristics of nuclear radiations, behaviour of ion pairs in electric field, detection and measurement of nuclear radiations using G. M. Counter and Scintillation Counter. 3.3 **Application of use of radioisotopes as Tracers:** chemical reaction mechanism, age determination - dating by C14. 3.4 **Nuclear reactions**: nuclear transmutation (one example for each projectile), artificial radioactivity, Q - value of nuclear reaction, threshold energy. 3.5 **Fission Process:** Fissile and fertile material, nuclear fission, chain reaction, factor controlling fission process. Multiplication factor and critical size or mass of fissionable material, nuclear power reactor and breeder reactor. 3.6 **Fusion Process:** Thermonuclear reactions occurring on stellar bodies and earth.	**15 L**
Unit-IV	**4.1SURFACE CHEMISTRY** **4.2 COLLOIDAL STATE**	4.1.1 **Adsorption:** Physical and Chemical Adsorption, types of adsorption isotherms. Langmuir‟s adsorption isotherm (Postulates and derivation expected). B.E.T. equation for multilayer adsorption, (derivation not expected). Determination of surface area of an adsorbent using B.E.T. equation. 4.2.1 **Introduction to colloids** - Emulsions, Gels and Sols 4.2.2 **Electrical Properties:** Origin of charges on colloidal particles, Concept of electrical double layer, zeta potential, Helmholtz and Stern model. Electro-kinetic phenomena - Electrophoresis, Electro-osmosis, Streaming potential,	**6L**

		Sedimentation potential; Donnan Membrane Equilibrium. 4.2.3 **Colloidal electrolytes :** Introduction, micelle formation, 4.2.3 **Colloidal electrolytes :** Introduction, micelle formation, 4.2.4 **Surfactants:** Classification and applications of surfactants in detergents and food industry.	

References:

1. Physical Chemistry, Ira Levine, 5th Edition, 2002 Tata McGraw Hill Publishing Co.Ltd.
2. Physical Chemistry, P.C. Rakshit, 6th Edition, 2001, Sarat Book Distributors, Kolkota.
3. Physical Chemistry, R.J. Silbey, and R.A. Alberty, 3rd edition , John Wiley and Sons, Inc [part 1]
4. Physical Chemistry, G. Castellan, 3rd edition, 5th Reprint, 1995 Narosa Publishing House.
5. Modern Electrochemistry, J.O.M Bockris and A.K.N. Reddy, Maria Gamboa – Aldeco 2nd Edition, 1st Indian reprint, 2006 Springer
6. Fundamental of Molecular Spectroscopy, 4th Edn., Colin N Banwell and Elaine M McCash Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2008.
7. Physical Chemistry, G.M. Barrow, 6th Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
8. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford Universtity Press Oxford.
9. Physical Chemistry, G.K. Vemullapallie, 1997, Prentice Hall of India, Pvt.Ltd. New Delhi.
10. Principles of Physical Chemistry B.R. Puri, L.R. Sharma, M.S. Pathania, VISHAL PUBLISHING Company, 2008.
11. Textbook of Polymer Science, Fred W Bilmeyer, John Wiley and Sons (Asia) Ple. Ltd., Singapore, 2007.
12. Polymer Science, V.R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar, New Age International (P) Ltd., Publishers, 2005.
13. Essentials of Nuclear Chemistry, Arnikar, Hari Jeevan , New Age International (P) Ltd., Publishers, 2011..
14. Chemical Kinetics,K. Laidler, Pearson Education India, 1987

Evaluation Pattern:

A) Continuous Evaluation (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, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	10
Total Marks		**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course Code	**USCHP501**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	-------

Course Code: USCHP501
Nomenclature: Physical Chemistry Practical
Course Outcomes: On completing the course, the student will understand

CO1 The Rast method for determining molar mass of compound.
CO2 Experimental determination of order of reaction by fractional change method.
CO3 validation of Freundlich adsorption isotherm
CO4 Determination of Solubility and Solubility product of Silver Chloride Potentiometrically
CO5 Determination of the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method.
CO6 The concept of isoelectric point, acidic and basic dissociation constants.

Curriculum:

Unit	Title	Learning Points	No of Credits
Non-Instrumental	**Colligative properties**	To determine the molecular weight of compound by Rast Method	**02**
	Chemical Kinetics	To determine the order between $K_2S_2O_8$ and KI by fractional change method.	
	Surface phenomena	To investigate the adsorption of acetic acid on activated charcoal and test the validity of Freundlich adsorption isotherm.	
Instrumental	**Potentiometry**	To determine the solubility product and solubility of AgCl Potentiometrically using chemical cell.	
	Conductometry	To determine the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method.	
	pH-metry	To determine acidic and basic dissociation constants of amino acid and hence to calculate isoelectric point.	

References:

1. Practical Physical Chemistry 3rd edition, A.M. Jones and F.E. Prichard,Longman Publications
2. Experiments in Physical Chemistry R.C.Das and B. Behra, TataMc Graw Hill
3. Advanced Practical Physical Chemistry J.B. Yadav, Goel Publication House
4. Advanced Experimental Chemistry Vol I J.N. Gurtu, and R. Kapoor, S Chandand Co.
5. Experimental Physical Chemistry l By V.D. Athavale
6. Senior Practical Physical Chemistry by B.D. Khosla, V.C. Garg and A. Gulati, R Chand and Company 2011.S

Evaluation Pattern: Practical Total Marks : 50

A) CIE/ 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.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce and Journal		05 + 05
Total			**50**

Marks in SEE practical examination 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	B.Sc.
Course Code	**USCH502**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	-----

Course Code: USCH502

Nomenclature: Inorganic Chemistry

Course Outcomes: After completion of the course student will able to

CO1 Identify the elements of symmetry.
CO2 Assign point groups to molecules.
CO3 Apply Molecular Orbital theory to polyatomic molecules
CO4 Depict structure of solids and their defects.
CO5 Explain Superconductivity and its applications
CO6 Understand occurrence, extraction, and separation of lanthanides by Ion Exchange method and (ii) Solvent extraction method.
CO7 Study Chemistry of non-aqueous solvents.
CO8 Explain Electronic configurations and allotropy of Group 16 elements.
CO9 Study chemistry of interhalogens.

Curriculum:

Unit	Title	Learning Points	No of Lectures
Unit I	**Molecular Symmetry and Chemical Bonding**	**1.1 Molecular Symmetry: (6L)** 1.1.1 Introduction and Importance of Symmetry in Chemistry. 1.1.2 Symmetry elements and Symmetry operations. 1.1.3 Concept of a Point Group with illustrations using the following point groups :(i)$C_{\infty V}$ (ii) $D_{\infty h}$ (iii) C_{2V} (iv) C_{3v} (v)C_{2h} and (vi)D_{3h}. **1.2 Molecular Orbital Theory for heteronuclear diatomic molecules and polyatomic species: (9L)** 1.2.1 Comparison between homonuclear and heteronuclear diatomic molecules. 1.2.2 Heteronuclear diatomic molecules like CO, NO and HCl. 1.2.3 Molecular orbital theory for H_3 and H_3^+ (correlation diagram expected). 1.2.4 Molecular shape to molecular orbital approach in AB_2 molecules. Application of symmetry concepts for linear and angular species considering σ-bonding only. (Examples like: i) BeH_2, ii) H_2O).	**15L**
Unit II	**Solid State Chemistry**	**2.1 Structures of Solids: (11L)** 2.2.1 Explanation of terms viz. crystal lattice, lattice point, unit cell and lattice constants. 2.1.2 Closest packing of rigid spheres (hcp, ccp), packing density in simple cubic, bcc and fcc lattices. Relationship between density, radius of unit cell and lattice parameters. 2.1.3 Stoichiometric Point defects in solids (discussion on Frenkel and Schottky defects expected). **2.2 Superconductivity: (4L)** 2.2.1 Discovery of superconductivity. Explanation of terms like superconductivity, transition temperature, Meissner effect. 2.2.2 Different types of super conductors viz.conventional superconductors, alkali metal fullerides, high temperature super conductors. 2.2.3 Brief application of superconductors.	**15L**

Unit III	**Chemistry Of Inner Transition Elements**	**3.0 Introduction:** **3.1** Position in periodic table and electronic configuration of lanthanides and actinides. **3.2 Chemistry of Lanthanides with reference to** (i) lanthanide contraction and its consequences(ii) Oxidation states (iii) Ability to form complexes (iv) Magnetic and spectral properties **3.3** Occurrence, extraction and separation of lanthanides by (i) Ion Exchange method and (ii) Solvent extraction method (Principles and technique) **3.4** Applications of lanthanides	**15L**
Unit IV	**Some Selected Topics**	**4.1 Chemistry of Non-aqueous Solvents (5 L)** 4.1.1 Classification of solvents and importance of non-aqueous solvents. 4.1.2 Characteristics and study of liquid ammonia, dinitrogen tetra oxide as non-aqueous solvents with respect to: (i) acid-base reactions and (ii) redox reactions. **4.2 Comparative Chemistry of Group 16 (5L)** 4.2.1 Electronic configurations, trends in physical properties, allotropy 4.2.2 Manufacture of sulphuric acid by Contact process. **4.3 Comparative Chemistry of Group 17 (5L)** 4.3.1Electronic configuration , General characteristics, anomalous properties of fluorine, comparative study of acidity of oxyacids of chlorine w.r.t acidity, oxidizing properties and structures(on the basis of VSEPR theory) 4.3.2 Chemistry of interhalogens with reference to preparations, properties and structures (on the basis of VSEPR theory).	**15L**

References:

1. Per Jensen and Philip R. Bunker , Fundamentals of Molecular Symmetry , Series in Chemical Physics, Taylor and Francis Group
2. J. S. Ogden, Introduction to Molecular Symmetry, Oxford University Press
3. Derek W. Smith, Molecular orbital theory in inorganic chemistry Publisher: Cambridge University Press
4. C. J. Ballhausen, Carl Johan Ballhausen, Harry B. Gray Molecular Orbital Theory: An Introductory Lecture Note and Reprint Volume Frontiers in chemistry Publisher W.A. Benjamin, 1965

5. Jack Barrett and Mounir A Malati, Fundamentals of Inorganic Chemistry, Affiliated East west Press Pvt. Ltd., New Delhi.
6. Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand and Co Ltd.
7. Lesley E. Smart, Elaine A. Moore Solid State Chemistry: An Introduction, 2nd Edition CRC Press,
8. C. N. R. Rao Advances in Solid State Chemistry
9. R.G. Sharma Superconductivity: Basics and Applications to Magnets
10. Michael Tinkham ,Introduction to Superconductivity: Vol I (Dover Books on Physics)
11. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.
12. Richard Harwood, Chemistry, Cambridge University Press,
13. Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry. S .Chand and Co Ltd .
14. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
15. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
16. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
17. G. Singh, Chemistry of Lanthanides and Actinides, Discovery Publishing House
18. Simon Cotton , Lanthanide and Actinide Chemistry Publisher: Wiley-Blackwell
19. B. H. Mahan, University Chemistry, Narosa publishing.
20. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.
21. J. D. Lee, Concise Inorganic Chemistry, 4thEdn., ELBS,
22. D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd edition, Oxford University Press.
23. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
24. Gary Wulfsberg, Inorganic chemistry, Viva Books Pvt,.Ltd. (2002).
25. Richard Harwood, Chemistry, chapter 10 Industrial inorganic chemistry
26. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
27. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993
28. Satya Prakash, G.D.Tuli, R.D. Madan, Advanced Inorganic Chemistry. S. Chand and Co Ltd 2004.

Evaluation Pattern:

A) Continuous Evaluation (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, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	10
Total		**40**

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.
2. Descriptive type of questions, derivation-based questions, problem solving / numerical based questions, etc., will contain internal options.
4. 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	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course Code	**USCHP502**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCHP502

Nomenclature: Inorganic Chemistry Practical

Course Outcomes: After completion of the course student will able to

CO1 Acquire skills to prepare Potassium diaquobis- (oxalato)cuprate (II)

CO2 Acquire skills to prepare Ferrous ethylene diammonium sulphate

CO3 Acquire skills to prepare bisacetylacetonatocopper(II)

CO4 Detect impurity in salt qualitatively.

CO5 Determine % purity of given salt

Curriculum:

Unit	Title	Learning Points	No of Cfredits
Non-Instrumental	Inorganic preparations	1. Preparation of Potassium diaquobis-(oxalato)cuprate (II) 2. Preparation of Ferrous ethylene diammonium sulphate. 3. Preparation of bisacetylacetonatocopper(II)	**02**
Non-Instrumental	Estimation And Qualitative Analysis	**Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests).** (Any three salts of transition metal ions)	

References:

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
2. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U. N. Dhur and Sons Pvt Ltd .
3. Vogel's. Text book of. Macro and Semi micro qualitative inorganic analysis. Fifth 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.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05 + 05
Total			**50**

Marks in SEE practical examination 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	B.Sc.
Course Code	**USCH503**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCH503

Nomenclature: Organic Chemistry

Course Outcomes: After studying this course, the learner will be able to:

CO1 Apply fundamentals of Organic Reaction Mechanism to various reactions.

CO2 Identify and Classify Pericyclic reactions.

CO3 Explain Jablonski diagram relating to photochemical phenomenon.

CO4 Discuss the various photochemical reactions.
CO5 Predict Molecular Chirality.
CO6 Define and differentiate between agrochemicals and understand their scope and significance.
CO7 Assign IUPAC names to spiro, bicyclo and heterocyclic compounds.

CO8 Extend green chemistry principles in organic chemistry and justify its applications in practical implementation

CO9 Explain the principle of spectroscopic methods (UV, Mass spectroscopy) and infer the different phenomenon involved in it.

CO10 Understand the fundamental concepts of natural products viz terpenoids, alkaloids and Hormones.

Curriculum:

Unit	Title	Learning Points	No of Lectures
Unit-I	**1.1 Mechanism of organic reactions**	1.1.1 The basic terms and concepts: bond fission, reaction intermediates, electrophiles and nucleophiles, ligand, base, electrophilicity vs. acidity and nucleophilicity vs basicity. 1.1.2 Neighbouring group participation in nucleophilic substitution reactions**:** participation of lone pair of electrons, kinetics and stereochemical outcome. 1.1.3 Acyl nucleophilic substitution (Tetrahedral mechanism): Acid catalyzed esterification of Carboxylic acids (AAC2) and base promoted hydrolysis of esters (BAC2). 1.1.4 Pericyclic reactions, classification and nomenclature 1.1.4.1 Electro cyclic reactions (ring opening and ring closing), cycloaddition, sigma tropic Rearrangement, group transfer reactions, cheletropic reaction (definition and one example of each type) 1.1.4.2 Pyrolytic elimination: Cope, Chugaev, pyrolysis of acetates	**10L**
	1.2 Photochemistry	1.2.1 Introduction: Difference between thermal and photochemical reactions. Jablonski diagram, singlet and triplet states, allowed and forbidden transitions, fate of excited molecules, Photosensitization. 1.2.2 Photochemical reactions of olefins: photoisomerization, photochemical rearrangement of 1,4-dienes (di- π methane) 1.2.3 Photochemistry of carbonyl compounds: Norrish I, Norrish II cleavages. Photo reduction (e.g.benzophenone to benzpinacol)	**5L**
Unit-II	**2.1 Stereochemistry I**	2.1.1 Molecular chirality and elements of symmetry: Mirror plane symmetry, inversion center, roation -reflection (alternating) axis. 2.1.2 Chirality of compounds without a stereo genic center: cummulenes and biphenyls.	**5L**
	2.2Agrochemicals	2.2.1 General introduction and scope, meaning and examples of insecticides, herbicides, fungicide, rodenticide, pesticides, plant growth regulators. 2.2.2 Advantages and disadvantages of agrochemicals 2.2.3 Synthesis and application of IAA (Indole Acetic Acid) and Endosulphan, 2.2.4 Bio pesticides – Neem oil and Karanj oil.	**4L**

	2.3 Heterocyclic chemistry	2.3.1 Reactivity of pyridine-N-oxide, quinoline and iso-quionoline. 2.3.2 Preparation of pyridine-N-oxide, quinoline (Skraup synthesis) and iso-quinoline (Bischler-Napieralski synthesis). 2.3.3 Reactions of pyridine-N-oxide: halogenation, nitration and reaction with $NaNH_2$/liq.NH_3,n-BuLi. 2.3.4 Reactions of quinoline and isoquinoline; oxidation,reduction,nitration,halogenation and reaction with $NaNH_2$/liq.NH_3,n-BuLi.	**6L**
Unit-III	**3.1 IUPAC**	IUPAC Systematic nomenclature of the following classes of compounds (including compounds upto two substituents / functional groups): 3.1.1 Bicyclic compounds – spiro, fused and bridged (upto 11 carbon atoms) – saturated and unsaturated compounds. 3.1.2 Biphenyls 3.1.3 Cummulenes with upto 3 double bonds 3.1.4 Quinolines and isoquinolines	**5L**
	3.2 Synthesis of organic compounds	3.2.1 Introduction: Linear and convergent synthesis, criteria for an ideal synthesis, concept of chemo selectivity and regioselectivity with examples, calculation of yields. 3.2.2 Multicomponent Synthesis: Mannich reaction and Biginelli reaction. Synthesis with examples (no mechanism) 3.2.3 Green chemistry and synthesis: Introduction: Twelveprinciples of green chemistry, concept of atom economy and E-factor, calculations and their significance, numerical examples. i) Green reagents: dimethyl carbonate. ii) Green starting materials : D-glucose iii) Green solvents : supercritical CO_2 iv) Green catalysts: Bio catalysts. 3.2.4 Planning of organic synthesis i) synthesis of nitroanilines. (*oandp*) ii) synthesis of halobenzoic acid.(*oandp*) iii) Alcohols (primary / secondary / tertiary) using Grignard reagents. iv) Alkanes (using organo lithium compounds)	**10L**
Unit-IV	**4.1 Spectroscopy I**	4.1.1 Introduction: Electromagnetic spectrum, units of wavelength and frequency 4.1.2 UV – Visible spectroscopy: Basic theory, solvents, nature of UV-Visible spectrum, concept of chromophore, auxochrome, bathochromic and hypsochromic shifts, hyperchromic and hypochromic effects, chromophore-chromophore and chromophore-	**5L**

	4.2 Natural Products	auxochrome interactions. 4.1.3 Mass spectrometry: Basic theory. Nature of mass spectrum. General rules of fragmentation. Importance of molecular ion peak, isotopic peaks, base peak, nitrogen rule, rule of 13 for determination of empirical formula and molecular formula. Fragmentation of alkanes and aliphatic carbonyl compounds. 4.2.1. Terpenoids: Introduction, Isoprene rule, special isoprene rule and the gem-dialkyl rule. 4.2.2 Citral: a) Structural determination of citral. b) Synthesis of citral from methyl heptenone c) Isomerism in citral. (cis and trans form). 4.2.3. Alkaloids Introduction and occurrence. Hofmann's exhaustive methylation and degradation in**:** simple open chain and N **–** substituted monocyclic amines. 4.2.4 Nicotine: a) Structural determination of nicotine. (Pinner's work included) b) Synthesis of nicotine from nicotinic acid c) Harmful effects of nicotine. 4.2.5 Hormones: Introduction, structure of adrenaline (epinephrine), physiological action of adrenaline. Synthesis of adrenaline from a) Catechol b) p-hydroxybenzaldehyde(Ott's synthesis)	**10L**

References:

1. A guidebook to mechanism in Organic Chemistry, 6**th** edition, Peter Sykes, Pearson education, New Delhi
2. Organic Reaction Mechanism, 4th edition, V. K. Ahluwalia, R. K. Parashar, Narosa Publication.
3. Organic reactions and their mechanisms,3rd revised edition, P.S. Kalsi, New Age International Publishers.
4. M.B.Smith and J. March, Advanced organic chemistry- reactions mechanism and structure, 5th edition.
5. Organic Chemistry, 7th Edition, R.T. Morrison, R. N. Boyd and S. K. Bhattacharjee, Pearson.
6. Organic chemistry,8th edition, John Mc Murry
7. L. Eliel , stereochemistry of carbon compounds, Tata McGraw Hill
8. Stereochemistry P.S.Kalsi , New Age International Ltd.,4th Edition
9. Stereochemistry by Nassipuri.
10. Insecticides and pesticides: Saxena A. B., Anmol publication.
11. Growth regulators in Agriculture and Horticulture: Amarjit Basra, CRC press 2000.
12. Agrochemicals and pesticides: A.Jadhav and T.V.Sathe.
13. Name Reactions in Heterocyclic Chemistry, Jie-Jack Li, Wiley-Interscience publications, 2005.

14. Handbook of Heterocyclic Chemistry, 2nd Edition, Alan R. Katritzky and Alexander F. Pozharskii, Elsevier Science Ltd, 2000.
15. Heterocyclic Chemistry, 5th Edition, John A. Joule and Keith Mills, Wiley publication, 2010.
16. Heterocyclic chemistry, 3rd Edition, Thomas L. Gilchrist, Pearson Education, 2007.
17. Nomenclature of Organic Chemistry**:** IUPAC recommendations and preferred Names 2013, RSC publication.
18. IUPAC nomenclature by S.C.Pal.
19. Green chemistry an introductory text : Mike Lancaster.
20. Green chemistry: V. K. Ahluwalia (Narosa publishing house pvt. ltd.)
21. Green chemistry an introductory text : RSC publishing.
22. New trends in green chemistry V. K. Ahluwalia , M. Kidwai, Klumer Academic publisher
23. Green chemistry by V. Kumar.
24. Organic chemistry: Francis Carey
25. Organic chemistry: Carey and Sundberg.
26. Organic spectroscopy (Second edition),Jag Mohan ,Narosa publication
27. Spectroscopy, Pavia, Lampman, Kriz,Vyvyan.
28. Elementary organic spectroscopy (Third edition), Y.R.Sharma, S.Chand publication..
29. Introduction to spectroscopy (third edition), Pavia ,Lampman,Kriz,john vondeling,Emily Barrosse.
30. Organic chemistry Paula Y. Bruice, Pearson education.
31. Spectral identification of organic molecules by Silverstein.
32. Absorption spectroscopy of organic molecules by V.M.Parikh.
33. Chemistry of natural products by Chatwal Anand – Vol I and Vol II
34. Chemistry of natural products by O.P. Agarwal
35. Chemistry of natural products by Meenakshi Sivakumar and Sujata Bhat.
36. Organic chemistry by Morrision and Boyd,7th edition.
37. I.L.Finar,Vol-I and Vol-II, 5th edition.

Evaluation Pattern:

B) Continuous Evaluation (40%) : 40 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 / project / worksheets / class tests	15
Attendance and active participation in classroom	05
Total	**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course Code	**USCHP503**
Class	T.Y. B.Sc.
Semester	V
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCHP503

Nomenclature: Organic Chemistry Practical

Course Outcomes: After studying this course, the learner will be able to:

CO1 Find the chemical type of mixture in the given binary mixture.

CO2 Decide scheme for separation of components using proper reagents.

CO3 Purify separated organic compound using different purification technique.

CO4 Identify Organic compound.

Curriculum:

Title	Learning Points	No of Credits
Separation of Binary solid-solid mixture (2.0 gms mixture to be given).	1. Minimum Six mixtures to be completed by the students.	**02**
	2. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols(2-naphthol, 1-naphthol), water insoluble bases (nitroanilines) , water soluble neutral (thiourea) and water insoluble neutral compounds (anilides, amides, m-DNB, hydrocarbons)	
	3. After correct determination of chemical type, the separating reagent should be decided by the student for separation	
	4. Follow separation scheme with the bulk sample of binary mixture.	
	5. After separation into component A and component B, one component (decided by the examiner) is to be analyzed and identified with m.p..	

References:

1. Practical organic chemistry – A. I. Vogel
2. Practical organic chemistry – H.Middleton.
3. Practical organic chemistry – O.P.Aggarwal.

Evaluation Pattern: Practical Total Marks: 50

1. 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**

2. Semester End Examination: 60% (30 Marks)

Sr. No.	Title	Method	Marks
1.	**Separation of Binary solid-solid mixture**	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05 + 05
Total			**50**

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	B.Sc.
Course Code	**USCH504**
Class	T.Y.B.Sc
Semester	V
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	----

Nomenclature: ANALYTICAL CHEMISTRY

Course Outcomes: On completion of this course the students will be able

CO1 Understand concepts and importance of Quality, Quality control and Quality assurance

CO2 do calculations relating to interconversion concentration

CO3 Elaborate on the need and importance of sampling and the various methods used for sampling of solid, liquids and gases.

CO4 Explain redox titration, redox indicators.

CO5 Explain the theory of matallochrome indicators and different types of EDTA titrations

CO6 Comprehend the principles, instrumentation and applications of Atomic Absorption Spectroscopy, and Flame emission spectroscopy

CO7 Discuss theory of molecular fluorescence and phosphorescence and instrumentation based on it.

CO8 Explain the basic principle of the solvent extraction and Define the terms partition coefficient and distribution ratio .

CO9 Describe Concept of [pH]1/2 and its significance.

CO10 understand principle of Solid phase extraction

CO11 Comprehend the principles, instrumentation and applications of HPLC and HPTLC and differentiate between TLC and HPTLC

Unit	Title	Learning Points	No of Lectures
UNIT I	**INTRODUCTION TO QUALITY CONCEPTS,CHEMICAL CALCULATIONS AND SAMPLING**	**1.1 Quality in Analytical Chemistry** 1.1.1 Concepts of Quality, Quality Control and Quality Assurance 1.1.2 Importance of Quality concepts in Industry 1.1.3 Chemical Standards and Certified Reference Materials; Importance in chemical analysis Quality of material: Various uses grades of laboratory reagents **1.2 Chemical Calculations (Numerical and word problems are expected)** 1.2.1 Inter conversion of various concentration units. (Conversion of concentration from one unit to another unit with examples) 1.2.2 Percent composition of elements in chemical compounds **1.3 Sampling** 1.3.1 Purpose, significance and difficulties encountered in sampling 1.3.2 Sampling of solids: Sample size – bulk ratio, size to weight ratio, multistage and sequential sampling, size reduction methods, sampling of compact solids, equipment and methods of sampling of compact solids, sampling of particulate solids, methods and equipment used for sampling of particulate solids. 1.3.3 Sampling of liquids: Homogeneous and heterogeneous, Static and flowing liquids. 1.3.4 Sampling of gases: Ambient and stack sampling: Apparatus and methods for sampling of gases. 1.3.5 Collection, preservation and dissolution of the sample.	**4L** **5L** **6L**
UNIT II	**CLASSICAL METHODS OF ANALYSIS (TITRIMETRY)**	**2.1 Redox Titrations (Numerical and word Problems are expected)** 2.1.1 Introduction 2.1.2 Construction of the titration curves and calculation of E_{system} in aqueous medium in case of: (1) One electron system (2) Multielectron system	**8L**

		2.1.3 Theory of redox indicators, Criteria for selection of an indicator Use of diphenyl amine and ferroin as redox indicators **2.2 Complexometric Titrations** 2.2.1 Introduction, construction of titration curve 2.2.2 Use of EDTA as titrant and its standardisation, absolute and conditional formation constants of metal EDTA complexes, Selectivity of EDTA as a titrant. Factors enhancing selectivity with examples. Advantages and limitations of EDTA as a titrant. 2.2.3 Types of EDTA titrations. 2.2.4 Metallochromic indicators, theory, examples and applications	**7L**
UNIT III	**OPTICAL METHODS**	**3.1 Atomic Spectroscopy: Flame Emission spectroscopy(FES) and Atomic Absorption Spectroscopy(AAS)** 3.1.1 Introduction, Energy level diagrams, Atomic spectra, Absorption and Emission Spectra 3.1.2 Flame Photometry – Principle, Instrumentation (Flame atomizers, types of Burners, Wavelength selectors, Detectors) 3.1.3 Atomic Absorption Spectroscopy – Principle, Instrumentation (Source, Chopper, Flame and Electro thermal Atomiser) 3.1.4 Quantification methods of FES and AAS – Calibration curve method, Standard addition method and Internal standard method. 3.1.5 Comparison between FES and AAS 3.1.6 Applications, Advantages and Limitations **3.2 Molecular Fluorescence and Phosphorescence Spectroscopy** 3.2.1 Introduction and Principle 3.2.2 Relationship of Fluorescence intensity with concentration 3.2.3 Factors affecting Fluorescence and Phosphorescence 3.2.4 Instrumentation and applications 3.2.5 Comparison of Fluorimetry and	**7L** **4L**

		Phosphorimetry 3.2.6 Comparison with Absorption methods **3.3 Turbidimetry and Nephelometry** 3.3.1 Introduction and Principle 3.3.2 Factors affecting scattering of Radiation: Concentration, particle size, wavelength, refractive index 3.3.3 Instrumentation and Applications	**4L**
UNIT IV	**METHODS OF SEPARATION – I**	**4.1 Solvent Extraction** 4.1.1 Factors affecting extraction: Chelation, Ion pair formation and Solvation 4.1.2 Graph of percent extraction versus pH. Concept of [pH]1/2 and its significance (derivation not expected) 4.1.3 Craig‟s counter current extraction: Principle, apparatus and applications 4.1.4 Solid phase extraction: Principle, process and applications with special reference to water and industrial effluent analysis. 4.1.5 Comparison of solid phase extraction and solvent extraction. **4.2 High Performance Liquid chromatography (HPLC)** 4.2.1 Introduction and Principle Instrumentation- components with their significance: Solvent Reservoir, Degassing system, Pumps-(reciprocating pumps, screw driven- syringe type pumps, pneumatic pumps, advantages and disadvantages of each pump), Precolumn, Sample injection system, HPLC Columns, Detectors(UV – Visible detector, Refractive index detector) 4.2.2 Qualitative and Quantitative Applications of HPLC **4.3 High Performance Thin Layer Chromatography (HPTLC)** 4.3.1 Introduction and Principle Stationary phase, Sample application and mobile phase	**6L** **6L** **3L**

		4.3.2 Detectors a) Scanning densitometer- Components. Types of densitometer- b) Single beam and Double beam c) Fluorometric Detector 4.3.3 Advantages, disadvantages and applications 4.3.4 Comparison of TLC and HPTLC	

References:

1. 3000 solved problems in Chemistry, David E.Goldberg,PhD.,Schaums Outline Unit/s: (1.2)
2. A guide to Quality in Analytical Chemistry: An aid to accreditation, CITAC and EURACHEM, (2002), Unit/s (1.1)
3. A premier sampling solids, liquids and gases, Smith Patricia I,American statistical association and the society for industrial and applied mathematics, (2001) Unit/s (1.3)
4. Analytical Chemistry, Gary.D Christan, 5th edition Unit/s (4.1,4.2,4.3)
5. Analytical Chemistry Skoog, West ,Holler,7th Edition: Unit/s (2.1)
6. Analytical Chromatography, Gurdeep R Chatwal, Himalaya Publication Unit/s (4.1,4.2,4.3)
7. Basic Concepts of Analytical Chemistry, by S M Khopkar, new Age International (p) Limited Unit/s (4.1,4.2,4.3)
8. Chemical methods of separation, J A Dean, Van Nostrand Reinhold, 1969 Unit/s (4.1,4.2,4.3)
9. Fundamentals of Analytical Chemistry by Skoog and West , 8th Edition Unit/s (4.1,4.2,4.3)
10. Handbook of quality assurance for the analytical chemistry laboratory, 2ndEdn., James P. DuxVanNostr and Reinhold,1990 Unit/s (1.1)
11. High Performance Thin Layer Chromatography by Dr P.D. Sethi, CBS Publisher and Distribution Unit/s(4.1,4.2,4.3)
12. High Performance Thin Layer Chromatography in Food analysis, by Prem kumar, CBS Publisher and distributer Unit/s (4.1,4.2,4.3)
13. Instrumental methods of Analysis, by Dr Supriya S Mahajan, Popular Prakashan Ltd Unit/s (4.1,4.2,4.3)
14. Instrumental methods Of Analysis, by Willard Merritt Dean, 7thEdition, CBS Publisher and distribution Pvt Ltd Unit/s (3.1,3.2,3.3)
15. Instrumental Methods of Chemical Analysis by B.K. Sharma Goel Publishing House Unit/s (4.1,4.2,4.3)
16. Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman Unit/s (4.1,4.2,4.3)(3.1,3.2,3.3)
17. Quality control and Quality assurance in Analytical Chemical Laboratory, Piotr Konieczka and Jacek Namiesnik, CRC press (2018) Unit/s (1.1)
18. Quality in the Analytical Chemistry Laboratory, Elizabeth Prichard, Neil T. Crosby, Florence Elizabeth Prichard, John Wiley and Sons, 1995 Unit/s (1.1)
19. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969 Unit/s (4.1,4.2,4.3)
20. Thin Layer Chromatography, A LAB. Handbook, Egon Stahl, Springer International Student Edition Unit/s (4.1,4.2,4.3)

Evaluation Pattern:

C) Continuous Evaluation (40%) : 40 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 / project / worksheets / class tests	15
Attendance and active participation in classroom	05
Total	**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc
Course Code	**USCHP504**
Class	T.Y.B.Sc
Semester	V
No of Credits	02
Nature	Practical
Type (applicable to NEP only)	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

CODE: USCHP504

Nomenclature: ANALYTICAL CHEMISTRY

Course Outcomes: On completion of this course the students will be able

CO1 Estimate amount of Fluoride in a sample Spectrophtometrically.

CO2 Estimate % of Magnesium in Talcum Powder complexometrically

CO3 Determine COD of water sample by redox titration method.

CO4 Determine % of Potassium in fertilizer sample using flame photometer.

CO5 Estimate amount of Sulphate in water sample using turbidimeter.

Curriculum:

Unit	Title	Learning Points	No of Credits
Non-Instrumental	**Complexometry**	Estimation of magnesium content in Talcum powder by complexometrically using standardized solution of EDTA	**02**
	Redox Titration	Determination of COD of water sample.	
	Redox Titration	To determine the amount of persulphate in the given sample solution by back titration with standard Fe (II) ammonium sulphate solution.	
Instrumental	**Spectrophotometry**	Spectrophotometric estimation of fluoride.	
	Flame Photometry	To determine potassium content of a Fertilizer by Flame Photometry (Calibration curve method	
	Turbidimetry	To determine the amount of sulphate in given water sample turbidimetrically.	

References:

1. Vogel‟s Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J Memdham and R C Denney, ELBS with Longmann (1989).

2. Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al
3. The chemical analysis of food and food products III edition Morris Jacob
4. The chemical analysis of food by David Pearson and Henry Edward

Evaluation Pattern: Practical Total Marks: 50

1. 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**

2. Semester End Examination: 60% (30 Marks)

Sr. No.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05+ 05
Total			**50**

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	B.Sc.
Course Code	**USCH601**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	-------

Course Code: USCH601

Nomenclature: Physical Chemistry

Course Outcomes: On completing the course, the student will be able to:

CO1 Understand the concept of activity and activity coefficient.
CO2 Classify different types of Concentration cells.
CO3 Recognize the concepts of Decomposition potential and Over voltage .
CO4 Classify polymers and determine their various types of molar masses
CO5 Explain Light emitting polymers ,uses of antioxidants, stabilizers, curing agents in a polymer.
CO6 Describe , Concept of operators State function and its significance
CO7 interprets the Schrodinger time-independent wave equation
CO8 Discuss importance of Renewable energy resources.
CO9 Understand the basic concepts of Nuclear Magnetic Resonance and electron spin resonance
CO10 Interpret NMR spectra after acquiring knowledge of its functioning, principle, chemical shift.

Curriculum :

Unit	Title	Learning Points	No of Lectures
Unit-I	**1.1 ELECTRO CHEMISTRY**	1.1.1 **Activity and Activity Coefficient:** Lewis concept, ionic strength, Mean ionic activity and mean ionic activity coefficient of an electrolyte, expression for activities of electrolytes. Debye-Huckel limiting law (No derivation). 1.1.2 **Classification of cells:** Chemical cells and Concentration cells. Chemical cells with and without transference, Electrode Concentration cells, Electrolyte concentration cells with and without transference (derivations are expected),	**7L**
	1.2 APPLIED ELECTRO CHEMISTRY	1.2.1 **Polarization**: concentration polarization and it‟s elimination 1.2.2 **Decomposition Potential and Overvoltage:** Introduction, experimental determination of decomposition potential, factors affecting decomposition potential. Tafel‟s equation for hydrogen overvoltage, experimental determination of over –voltage	**8L**
Unit-II	**2.0 POLYMERS**	2.1 **Basic terms:** macromolecule, monomer, repeat unit, degree of polymerization. 2.2. **Classification of polymers:** Classification based on source, structure, thermal response and physical properties. 2.3. **Molar masses of polymers:** Number average, Weight average, Viscosity average molar mass, Monodispersity and Polydispersity 2.4. **Method of determining molar masses of polymers :** Viscosity method using Ostwald Viscometer. (derivation expected) 2.5. **Light Emitting Polymers:** Introduction, Characteristics, Method of preparation and applications. 2.6. **Antioxidants and Stabilizers:** Antioxidants, Ultraviolet stabilizers, Colourants, Antistatic agents and Curing agents.	**15L**
Unit-III	**3.1 BASICS OF QUANTUM CHEMISTRY**	3.1.1 **Classical mechanics**: Introduction, limitations of classical mechanics, Black body radiation, photoelectric effect, Compton effect. 3.1.2 **Quantum mechanics:** Introduction, Planck‟s theory of quantization, wave particle duality, de – Broglie‟s equation, Heisenberg‟s uncertainty principle. 3.1.3 **Progressive and standing waves-** Introduction, boundary conditions, Schrodinger‟s time independent wave equation (No derivation	**10L**

	3.2 RENEWABLE ENERGY RESOURCES	expected), interpretation and properties of wave Function. 3.1.4 **Quantum mechanics** : State function and its significance, Concept of operators - definition, addition, subtraction and multiplication of operators, commutative and non - commutative operators, linear operator, Hamiltonian operator, Eigen function and Eigen value. 3.2.1. **Renewable energy resources:** Introduction. 3.2.2 **Solar energy**: Solar cells, Photovoltaic effect, Differences between conductors, semiconductors, insulators and its band gap, Semiconductors as solar energy converters, Silicon solar cell 3.2.3. **Hydrogen:** Fuel of the future, production of hydrogen by direct electrolysis of water, advantages of hydrogen as a universal energy medium.	**5L**
Unit-IV	**4.1 NMR - NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY** **4.2 ELECTRON SPIN RESONANCE SPECTROSCOPY**	**4.1.1. Principle** : Nuclear spin, magnetic moment, nuclear „g‟ factor, energy levels, Larmor precession, Relaxation processes in NMR (spin -spin relaxation and spin - lattice relaxation). **4.1.2. Instrumentation**: NMR Spectrometer **4.2.1. Principle**: fundamental equation, g-value – dimensionless constant or electron g-factor, hyperfine splitting. **4.2.2. Instrumentation**: ESR spectrometer, ESR spectrum of hydrogen and deuterium.	**7L** **8L**

Learning Resources recommended:

1. Physical Chemistry, Ira Levine, 5th Edition, 2002 Tata McGraw Hill Publishing Co.Ltd.
2. Physical Chemistry, P.C. Rakshit, 6th Edition, 2001, Sarat Book Distributors, Kolkota.
3. Physical Chemistry, R.J. Silbey, and R.A. Alberty, 3rd edition , John Wiley and Sons, Inc [part 1]
4. Physical Chemistry, G. Castellan, 3rd edition, 5th Reprint, 1995 Narosa Publishing House.
5. Modern Electrochemistry, J.O.M Bockris and A.K.N. Reddy, Maria Gamboa – Aldeco 2nd Edition, 1st Indian reprint,2006 Springer
6. Fundamental of Molecular Spectroscopy, 4th Edn., Colin N Banwell and Elaine M McCash Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2008.
7. Physical Chemistry, G.M. Barrow, 6th Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
8. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford Universtity Press Oxford.
9. Physical Chemistry, G.K. Vemullapallie, 1997, Prentice Hall of India, Pvt.Ltd. New Delhi.
10. Principles of Physical Chemistry B.R. Puri, L.R. Sharma, M.S. Pathania, VISHAL PUBLISHING Company, 2008.

11. Textbook of Polymer Science, Fred W Bilmeyer, John Wiley and Sons (Asia) Ple. Ltd., Singapore, 2007.
12. Polymer Science, V.R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar, New Age International (P) Ltd., Publishers, 2005.
13. Essentials of Nuclear Chemistry, Arnikar, Hari Jeevan , New Age International (P) Ltd., Publishers, 2011..
14. Chemical Kinetics, K. Laidler, Pearson Education India, 1987.

Evaluation Pattern:

D) Continuous Evaluation (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, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	10
	Total	**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course Code	**USCHP601**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCHP601

Nomenclature: Physical Chemistry Practical

Course Outcomes: On completing the course, the student will able to

CO1 Interpret the order of reaction graphically
CO2 Determine the molecular weight of polymer by viscosity measurement.
CO3 Estimate the amount % of Iodide, bromide,and chloride in mixture of halide Potentiometrically.
CO4 Determine the number of electrons involved in redox reaction Potentiometric ally
CO5 Estimate the amount / % Strong acid and Weak acid in a mixture conductometrically.
CO6 Estimate the amount of Fe(III) in the complex formation with salicylic acid by Static method.

Curriculum:

Unit	Title	Learning Points	No of credits
Non-Instrumental	**Chemical Kinetics**	To interpret the order of reaction graphically from the given experimental data and calculate the specific rate constant. (No fractional order)	**02**
	Viscosity	To determine the molecular weight of high polymer polyvinyl alcohol (PVA) by viscosity measurement.	
Instrumental	**Potentiometry**	To determine the amount of iodide, bromide and chloride in the mixture by Potentiometric titration with silver nitrate. To determine the number of electrons in the redox reaction between ferrous ammonium sulphate. and cerric sulphate Potentiometrically.	
	Conductometry	To titrate a mixture of weak acid and strong acid against strong base and estimate the amount of each acid in the mixture conductometrically.	
	Colorimetry	To estimate the amount of Fe(III) in the complex formation with salicylic acid by Static Method.	

Learning Resources recommended:

1. Practical Physical Chemistry 3rd edition, A.M. Jones and F.E. Prichard,Longman Publications
2. Experiments in Physical Chemistry R.C.Das and B. Behra, TataMc Graw Hill
3. Advanced Practical Physical Chemistry J.B. Yadav, Goel Publication House
4. Advanced Experimental Chemistry Vol I J.N. Gurtu, and R. Kapoor, S Chandand Co.
5. Experimental Physical Chemistry l By V.D. Athavale

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.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce		10
Total			**50**

Marks in SEE practical examination 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	B.Sc.
Course Code	**USCH602**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCH602

Nomenclature: Inorganic Chemistry

Course Outcomes: After completion of the course student will able to

CO1 Apply Crystal field theory to octahedral complexes.

CO2 Calculate CFSE of complexes, and thus predict stability.

CO3 Construct ligand group orbitals, σ-molecular orbitals for an ML6 complex.

CO4 Study Thermodynamic and Kinetic Stability of Complexes.

CO5 Correlate between electronic configurations and lability of complexes

CO6 Understand General characteristics of various types of organometallic compounds

CO7 Illustrate Synthesis, properties, structure of Ferocene

CO8 Discuss metallurgy of copper.

Curriculum:

Unit	Title	Learning Points	No of Lectures
Unit I	**Theories of the metal-ligand bond (I)**	1.1 Limitations of Valence Bond Theory. 1.2 Crystal Field Theory and effect of crystal field on central metal valence orbitals in various geometries from linear to octahedral(from coordination number 2 to coordination number 6) 1.3 Splitting of *d* orbitals in octahedral, square planar and tetrahedral crystal fields. 1.4 Distortions from the octahedral geometry: (i) effect of ligand field and (ii) Jahn-Teller distortions. 1.5 Crystal field splitting parameters Δ; its calculation and factors affecting it in octahedral complexes, Spectrochemical series. 1.6 Crystal field stabilization energy (CFSE), calculation of CFSE for octahedral complexes with d^0 to d^{10} metal ion configurations. 1.7 Consequences of crystal field splitting on various properties such as ionic radii, hydration energy and enthalpies of formation of metal complexes of the first transition series. 1.8 Limitations of CFT: Evidences for covalence in metal complexes (i) Intensities of d-d transitions, (ii) ESR spectrum of $[IrCl6]^{2-}$ (iii) Nephelauxetic effect.	**15L**
Unit II	**Theories of the metal-ligand bond (II)**	**2.1 Molecular orbital Theory for coordination compounds. (4L)** 2.1.1 Identification of the central metal orbitals and their symmetry suitable for formation of σ bonds with ligand orbitals. 2.1.2 Construction of ligand group orbitals. 2.1.3 Construction of σ-molecular orbitals for an ML6 complex. 2.1.4 Effect of σ-bonding on complexes. 2.1.5 Examples like $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$, $[FeF_6]^{-3}$, $[Fe(CN)_6]^{-3}$, $[CoF_6]^{-3,}$ $[Co(NH_3)_6]^{+3}$ **2.2 Stability of Metal-Complexes (4L)** 2.2.1 Thermodynamic and kinetic perspectives of metal complexes with examples. 2.2.2 Stability constants: stepwise and overall stability constants and their interrelationship. 2.2.3 Factors affecting thermodynamic stability. **2.3 Reactivity of metal complexes. (4L)** 2.3.1 Comparison between Inorganic and organic reactions. 2.3.2 Types of reactions in metal complexes. 2.3.3 Inert and labile complexes: correlation between electronic configurations and lability of complexes. 2.3.4 Ligand substitution reactions: Associative and	**15L**

		Dissociative mechanisms. 2.2.5 Acid hydrolysis, base hydrolysis and anation reactions. **2.4 Electronic Spectra. (3L)** 2.4.1 Origin of electronic spectra 2.4.2 Types of electronic transitions in coordination compounds: intra- ligand, Charge transfer and intra-metal transitions. 2.4.3 Selection rules for electronic transitions. 2.4.4 Electronic configuration and electronic micro states, Terms and Term symbols for transition metal ions, rules for determination of ground state term. 2.4.5 Determination of Terms for p^2 and d^1 electronic configurations.	
Unit III	**Organometallic Chemistry**	**3.1 Organometallic Compounds of main group metal (6L)** 3.1.1 General characteristics of various types of organometallic compounds, viz. ionic, σ-bonded and electron deficient compounds. 3.1.2 General synthetic methods of organometallic compounds: (i) Oxidative-addition, (ii) Metal-metal exchange (transmetallation), (iii) Carbanion-halide exchange, (iv) Metal-hydrogen exchange (metallation) and (v) Methylene insertion reactions. 3.1.3 Some chemical reactions of organometallic compounds: (i) Reactions with oxygen and halogens, (ii) Alkylation and arylation reactions (iii) Reactions with protic reagents, (iv) Redistribution reactions and (v) Complex formation reactions. **3.2 Metallocenes (5L)** Introduction, Ferrocene: Synthesis, properties, structure and bonding on the basis of VBT. **3.3 Catalysis (4L)** 3.3.1 Comparison between homogeneous and heterogeneous catalysis 3.3.2 Basic steps involved in homogeneous catalysis 3.3.3 Mechanism of Wilkinson‟s catalyst in hydrogenation of alkenes.	**15L**
Unit IV	**Some Selected Topics**	**4.1 Metallurgy (7L)** 4.1.1 Types of metallurgies, 4.1.2 General steps of metallurgy; Concentration of ore, calcinations, roasting, reduction and refining. 4.1.3 Metallurgy of copper: occurrence, physicochemical principles, Extraction of copper from pyritesand refining by electrolysis. **4.2 Chemistry of Group 18 (5L)** 4.2.1 Historical perspectives 4.2.2 General characteristics and trends in physical and chemical properties 4.2.3 Isolation of noble gases 4.2.4 Compounds of Xenon (oxides and fluorides) with respect to preparation and structure (VSEPR)	**15L**

		4.2.5 Uses of noble gases **4.3 Introduction to Bioinorganic Chemistry. (3L)** 4.3.1Essential and non-essential elements in biological systems. 4.3.2 Biological importance of metal ions such as Na^+,K^+,Fe^{+2}/Fe^{+3} and Cu^{+2}(Role of Na^+ and K^+ w. r. t ion pump)	

References:

1. Geoffrey A. Lawrance Introduction to Coordination Chemistry John Wiley and Sons.
2. R. K. Sharma Text Book of Coordination Chemistry Discovery Publishing House
3. R. Gopalan , V. Ramalingam Concise Coordination Chemistry , Vikas Publishing House;
4. Shukla P R, Advance Coordination Chemistry , Himalaya Publishing House
5. Glen E. Rodgers, Descriptive Inorganic, Coordination, and Solid-State Chemistry Publisher: Thomson Brooks/Cole
6. Ramesh Kapoor and R.S. Chopra, **Inorganic Chemistry**, R. Chand publishers,
7. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley and Sons, NY,
8. Twigg, Mechanisms of Inorganic and Organometallic Reactions Publisher: Springer
9. R.K. Sharma Inorganic Reaction Mechanisms Discovery Publishing House
10. M. L. Tobe Inorganic Reaction Mechanisms Publisher Nelson, 1972
11. Cotton, Wilkinson, Murillo and Bochmann, Advanced **Inorganic Chemistry**, 6th Edition..
12. H.W. Porterfield, Inorganic Chemistry, Second Edition, Academic Press, 2005
13. Purecell, K.F. and Kotz, J.C., Inorganic Chemistry W.B. Saunders Co. 1977.
14. Robert H. Crabtree ,The Organometallic Chemistry of the Transition Metals, Publication by John Wiley and Sons
15. B D Gupta and Anil J Elias Basic Organometallic Chemistry: Concepts, Syntheses and Applications, University press
16. Ram Charan Mehrotra, Organometallic Chemistry: A Unified Approach, New Age International.
17. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.
18. D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd edition, Oxford University Press
19. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
20. Jack Barrett and Mounir A Malati, Fundamentals of Inorganic Chemistry, Affiliated East west Press Pvt. Ltd., New Delhi.
21. R.Gopalan, Chemistry for undergraduates. Chapter 18. Principles of Metallurgy. (567-591)
22. Puri, Sharma Kalia Inorganic chemistry. Chapter 10, Metals and metallurgy.(328-339)
23. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
24. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
25. Lippard, S.J. and Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
26. Satya Prakash, G. D. Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand and Co Ltd

Evaluation Pattern:

E) Continuous Evaluation (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, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	10
Total		**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course Code	**USCHP602**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	------

Course Code: USCHP602

Nomenclature: Inorganic Chemistry Practical

Course Outcomes: After completion of the course student will able to

CO1 Acquire skills to prepare Tris(acetylacetonato) iron(III)

CO2 Acquire skills to prepare bis(dimethylglyoximato) nickel(II)

CO3 Acquire skills to prepare potassium trioxalato aluminate (III)

CO4 Detect impurity in salt qualitatively.

CO5 Determine % purity of given salt

Curriculum:

Unit	Title	Learning Points	No of credits
Non-Instrumental	**Inorganic preparations**	1. Preparation of Tris(acetylacetonato) iron(III) 2. Green synthesis of bis(dimethylglyoximato) nickel(II) complex using nickel carbonate and sodium salt of dmg 3. Preparation of potassium trioxalato aluminate (III)	**02**
	Estimation and Qualitative Analysis	Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests). (Any three salts of main group metal ions)	

References :

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
2. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U. N. Dhur and Sons Pvt Ltd .
3. Vogel's. Text book of. Macro and Semi micro qualitative inorganic analysis. Fifth 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.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05 + 05
Total			**50**

Marks in SEE practical examination 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	B.Sc.
Course Code	**USCH603**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	----------

Course Code: USCH603

Nomenclature: Organic Chemistry

Course Outcomes: After studying this course, the learner will be able to:

CO1 Define and differentiate between stereoselectivity and stereo specificity.
CO2 Apply stereochemistry concepts to addition, substitution reactions

CO3 Understand nature of peptide bond and discuss synthesis of Polypeptides and structure of proteins.
CO4 Explain mechanism of molecular rearrangements.

CO5 Classify carbohydrates and draw conformations of different carbohydrate molecules.

CO6 Study reactions of Glucose and fructose
CO7 Understand and differentiate between various foundational terms in polymer chemistry.

CO8 Elucidate structure of organic compounds based on UV, IR and NMR spectral information.

CO9 Demonstrate knowledge in functional group transformations using catalysts and reagents.

Curriculum:

Unit	Title	Learning Points	No of Lectures
Unit-I	**1.1 Stereochemistry II**	1.1.1 Stereoselectivity and stereo specificity: Idea of enantioselectivity (ee) and diastereoselectivity (de) , Topicity : enantiotopic and diasterotopic atoms, groups and faces. 1.1.2 Stereochemistry of – i) Substitution reactions : SN_1 (reaction of alcohol with thionyl chloride) ii) Elimination reactions: E2–Base induced dehydrohalogenation of 1-bromo-1,2-diphenylpropane. iii) Addition reactions to olefins: a) bromination (electrophilic anti addition) b) syn hydroxylation with OsO4 and KMnO4 c) epoxidation followed by hydrolysis.	**10L**
	1.2 Amino acids and Proteins	**1.2.1** α-Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalamide synthesis. **1.2.2** Polypeptides and Proteins: nature of peptide bond. Nomenclature and representation of polypeptides (di-and tri-peptides) with examples Merrifield solid phase polypeptide synthesis. Protiens:general idea of primary,secondary,tertiary and quaternary structure	**5L**
Unit-II	**2.1 Molecular Rearrangements**	Mechanism of the following rearrangements with examples and stereochemistry wherever applicable. 2.1.1 Migration to the electron deficient carbon: Pinacol-pinacolone rearrangement. 2.1.2 Migration to the electron deficient nitrogen: Beckmann rearrangement. 2.1.3 Migration involving a carbanion : Favorski rearrangement. 2.1.4 Name reactions: Michael addition, Wittig reaction.	**5L**
	2.2 Carbohydrates	2.2.1 Introduction: classification, reducing and non-reducing sugars, DL notation 2.2.2 Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharides) and Haworth formula (furanose and pyranose forms of pentoses and hexoses)	**10L**

		Interconversion: open chain and Haworth forms of monosaccharides with 5 and 6 carbons. Chair conformation with stereochemistry of D-glucose, Stability of chair form of D-glucose 2.2.3 Stereoisomers of D-glucose: enantiomer, diastereomers, anomers, epimers. 2.2.4 Mutarotation in D-glucose with mechanism 2.2.5 Chain lengthening and shortening reactions: Modified Kiliani-Fischer synthesis (D-arabinose to D-glucose and D-mannose), Wohl method (D-glucose to D-arabinose) 2.2.6 Reactions of D-glucose and D-fructose: (a) Osazone formation (b) reduction: Hi/Ni, NaBH4 (c) oxidation: bromine water, HNO3, HIO4 (d) acetylation (e) methylation:(d) and (e) with cyclic pyranose forms 2.2.7 Glycosides: general structure	
Unit-III	**3.1 Spectroscopy II**	**3.1.1** IR Spectroscopy: Basic theory, nature of IR spectrum, selection rule, fingerprint region. **3.1.2** PMR Spectroscopy: Basic theory of PMR, nature of PMR spectrum, chemical shift (δ unit), standard for PMR, solvents used. Factors affecting chemical shift: (1) inductive effect (2) anisotropic effect (with reference to C=C, C≡C, C=O and benzene ring). Spin- spin coupling and coupling constant. application of deuterium exchange technique. application of PMR in structure determination. **3.1.3** Spectral characteristics of following classes of organic compounds, including benzene and monosubstituted benzenes, with respect to IR and PMR: (1) alkanes (2) alkenes (3) alkynes (4) haloalkanes (5) alcohols (6) carbonyl compounds (7) ethers (8) amines (broad regions characteristic of different groups are expected). Problems of structure elucidation of simple organic compounds using individual or combined use of UV-Vis, IR, Mass and NMR spectroscopic technique are expected. (Index of hydrogen deficiency should be the first step in solving the problems).	**10L**
	3.2 Nucleic Acids	Controlled hydrolysis of nucleic acids. sugars and bases in nucleic acids. Structures of nucleosides and nucleotides in DNA and RNA. Structures of nucleic acids (DNA and RNA) including base pairing.	**5L**

Unit-IV	**4.1 Polymer**	4.1.1 Introduction: terms monomer, polymer, homopolymer, copolymer, thermo plastics and thermosets. 4.1.2 Addition polymers: polyethylene, polypropylene, teflon, polystyrene, PVC, Uses. 4.1.3 Condensation polymers: polyesters, polyamides, polyurethanes, polycarbonates, phenol formaldehyde resins. Uses 4.1.4 Stereochemistry of polymers: Tacticity, mechanism of stereochemical control of polymerization using Ziegler Natta catalysts. 4.1.5 Natural and synthetic rubbers: Polymerisation of isoprene: 1,2 and 1,4 addition (cis and trans), Styrene butadiene copolymer. 4.1.6 Additives to polymers: Plasticisers, stabilizers and fillers. 4.1.7 Biodegradable polymers: Classification and uses. polylactic acid structure, properties and use for packaging and medical purposes. (Note : Identification of monomer in a given polymer and structure of polymer for a given monomer is expected. condition for polymerization is not expected)	**8L**
	4.2 Catalysts and Reagents	Study of the following catalysts and reagents with respect to functional group transformations and selectivity (no mechanism). **4.2.1** Catalysts: Catalysts for hydrogenation: a. Raney Nickel b. Pt and PtO_2 (C=C, CN, NO_2, aromatic ring) c. Pd/C : C=C, COCl→CHO (Rosenmund) d. Lindlar catalyst: alkynes **d.2.2** Reagents**:** a. $LiAlH_4$ (reduction of CO, COOR, CN,NO_2) b. $NaBH_4$ (reduction of CO) c. SeO_2 (CH_2 alpha to CO) d. mCPBA (epoxidation of C=C) e. NBS (allylic and benzylic bromination)	**7L**

References:

1. Refer Stereochemistry –I (Sem-V, Unit-II)
2. Biochemistry, 8th Ed., Jeremy Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto Pub. W. H. Freeman Publishers
3. Lehninger Principles of Biochemistry 7th Ed., David Nelson and Michael Cox, Publisher W. H. Freeman
4. Name Reactions – Jie Jack Li, 4th Edition, Springer Pub.
5. Refer Mechanism of organic reaction (Sem-V, Unit-I)
6. Organic chemistry (fourth edition),G,Marc Loudon,Oxford University press.
7. Introduction to Organic Chemistry (Third edition), Andrew Streitwieser, Jr. Clayton H. Heathcock, Macmilan publishing.
8. Organic chemistry fourth edition, Morrision and Boyd.
9. Introduction to Organic chemistry,John McMurry.
10. Organic chemistry volume-1and2 (fifth and sixth edition) IL Finar.
11. Refer spectroscopy –I, (Sem-V, Unit-IV)
12. Organic chemistry R.T.Morrison and R.N.Boyd, 6th edition, pearson education
13. S.H.Pine, organic chemistry 4th edition. McGraw Hill
14. Polymer chemistry by M.G.Arora, K.Singh.
15. Polymer science – a text book by Ahluwalia and Mishra
16. Introduction to polymer chemistry - R.Seymour, Wiley Interscience.
17. Organic chemistry by Francis Carey – McGrawHill .
18. Organic chemistry by Carey and Sundberg, Part A and B

Evaluation Pattern:

A) Continuous Evaluation (40%): 40 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
Assignments / seminar / project / worksheets / class tests	15
Attendance and active participation in classroom	05
Total	**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc.
Course code	**USCHP603**
Class	T.Y. B.Sc.
Semester	VI
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	----------

Course Code : USCHP603

Nomenclature: Organic Chemistry Practical

Course Outcomes: After studying this course, the learner will be able to:

CO1 Find the chemical type of mixture in the given binary mixture

CO2 Decide scheme for separation of components using proper reagents.

CO3 Purify separated organic compound using different purification technique.

CO4 Identify Organic compound.

Curriculum:

Title	Learning Points	No of credits
Separation of Binary liquid-liquid and liquid-solid mixture.	1. Minimum Six mixtures to be completed by the students.	**02**
	2. Components of the liq-liq mixture should include volatile liquids like acetone, methylacetate, ethylacetate, isopropylalcohol, ethyl alcohol, EMK and non volatile liquids like chlorobenzene , bromobenzene, aniline, N,N dimethylaniline, acetophenone, nitrobenzene, ethyl benzoate.	
	3. Components of the liq- solid mixture should include volatile liquids like acetone, methylacetate, ethylacetate, ethyl alcohol, IPA, EMK and solids such as water insoluble acids, phenols, bases, neutral.	
	4. A sample of the mixture one ml to be given to the	

	student for detection of the physical type of the mixture.	
	5. After correct determination of physical type, separation of the binary mixture to be carried out by distillation method using micro scale technique.	
	6. After separation into component A and component B, the compound to be identified can be decided by examiner	

References :

1. Practical organic chemistry – A. I. Vogel
2. Practical organic chemistry – H.Middleton.
3. Practical organic chemistry – O.P.Aggarwal

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.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05+ 05
Total			**50**

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	B.Sc
Course Code	**USCH604**
Class	T.Y.B.Sc
Semester	VI
No of Credits	02
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	--------

COURSE CODE: USCH604

Nomenclature: ANALYTICAL CHEMISTRY

Course Outcomes: On completion of this course the students will be able

CO1 understand basic principle of Polarography, amperometric titration

CO2 explain different terms involved in polarography
CO3 Solve Ilkovic equation for quantitative analysis using polarographic method
CO4 understand theory, principle and instrumentation of Gas Chromatography

CO5 Discuss Ion exchange Chromatography and its applications.
CO6 explain food preservation techniques, determination of boric acid by titrimetry mthod

CO7 understand various constituents in food maerial like tea, coffee, milk

CO8 explain chemical composition in Talcum powder, Deodernts

CO9 understand theory, principle, instrumentation and application of TGA and DTA

CO10 Describe Thermometric titration and its application

CO11 explain need of method validation and its parameters

Curriculum:

Unit	Title	Learning Points	No of Lectures
UNIT I	**ELECTRO ANALYTICAL TECHNIQUES**	**1.1 Polarography (Numerical and word problems are expected)** 1.1.1 Difference between potentiometry and voltammetry, Polarizable and non-polarizable electrodes 1.1.2 Basic principle of polarography H shaped polarographic cell, DME (construction, working, advantages and limitations) 1.1.3 DC polarogram: Terms involved - Residual current, Diffusion current, Limiting current, Half-Wave Potential Role and selection of supporting electrolyte, Interference of oxygen and its removal, polarographic Maxima and Maxima Suppressors Qualitative aspects of Polarography: Half wave potential E1/2, Factors affecting E1/2 Quantitative aspects of polarography: Ilkovic equations: various terms involved in it (No derivation) 1.1.4 Quantification 1) Wave height – Concentration plots (working plots/calibration) 2) Internal standard (pilot ion) method 3) Standard addition method 1.1.5 Applications advantages and limitations **1.2 Amperometric Titrations** 1.2.1 Principle, Rotating Platinum Electrode(Construction, advantages and limitations) 1.2.2 Titration curves with example 1.2.3 Advantages and limitations	**11L** **4L**
UNIT II	**METHODS OF SEPARATION - II**	**2.1 Gas Chromatography (Numerical and word problems are expected)** 2.1.1 Introduction, Principle, Theory and terms involved 2.1.2 Instrumentation: Block diagram and components, types of columns, stationary phases in GSC and GLC, Detectors: TCD, FID, ECD 2.1.3 Qualitative, Quantitative analysis and applications 2.1.4 Comparison between GSC and GLC **2.2 Ion Exchange Chromatography** 2.2.1 Introduction, Principle. 2.2.2 Types of Ion Exchangers , Ideal	**9L** **6L**

		properties of resin 2.2.3 Ion Exchange equilibria and mechanism, selectivity coefficient and separation factor Factors affecting separation of ions 2.2.4 Ion exchange capacity and its determination for cation and anion exchangers. 2.2.5 Applications of Ion Exchange Chromatography with reference to Preparation of demineralized water, Separation of amino acids	
UNIT III	**FOOD AND COSMETICS ANALYSIS**	**3.1 Introduction to food chemistry** 3.1.1 Food processing and preservation: Introduction, need, chemical methods, action of chemicals(sulphur dioxide, boric acid, sodium benzoate, acetic acid, sodium chloride and sugar) and pH control Physical methods (Pasteurization and Irradiation) 3.1.2 Determination of boric acid by titrimetry and sodium benzoate by HPLC. 3.1.3 Study and analysis of food products and detection of adulterants **1)** Milk: Composition and nutrients, types of milk (fat free, organic and lactose milk) Analysis of milk for lactose by Lane Eynon‟s Method **2)** Honey: Composition Analysis of reducing sugars in honey by Coles Ferricyanide method **3)** Tea: Composition, types (green tea and mixed tea) Analysis of Tannin by Lowenthal‟s method **4)** Coffee: Constituents and composition, Role of Chicory, Analysis of caffeine by Bailey Andrew method **3.2 Cosmetics** 3.2.1 Introduction and sensory properties 3.2.2 Study of cosmetic products – **1)** Face powder: Composition Estimation of calcium and magnesium by complexometric titration **2)** Lipstick: Constituents Ash analysis for water soluble salts: borates, carbonates and zinc oxide **3)** Deodorants and Antiperspirants: Constituents, properties Estimation of zinc by gravimetric method.	**10L** **5L**
UNIT IV	**THERMAL METHODS AND ANALYTICAL METHOD VALIDATION**	**4.1 Thermal Methods** 4.1.1 Introduction to various thermal methods (TGA, DTA and Thermometric titration) 4.1.2 **Thermogravimetric Analysis(TGA)** Instrumentation-block diagram,thermobalance (Basic components: balance, furnace,	**12L**

		temperature measurement and control, recorder) Thermogram (TG curve)for$CaC_2O_4.H_2O$ and $CuSO_4.5H_2O$ Factors affecting thermogram- Instrumental factors and Sample characteristics Applications: Determination of drying and ignition temperature range Determination of percent composition of binary mixtures (Estimation of Calcium and Magnesium oxalate) 4.1.3 **Differential Thermal Analysis (DTA):** Principle**,** Instrumentation, and Reference material used Differential thermogram (DTA curve) CaC_2O_4 .H_2O and $CuSO_4.5H_2O$ Applications Comparison between TGA and DTA. 4.1.4 **Thermometric Titrations –** Principle and Instrumentation Thermometric titrations of : 1) HCl v/s NaOH 2) Boric acid v/s NaOH 3) Mixture of Ca^{+2} and Mg^{+2} v/s EDTA 4) Zn^{+2} with Disodium Tartarate**.** **4.2 Analytical Method Validation** 4.2.1 Introduction and need for validation of a method 4.2.2 Validation Parameters: Specificity, Selectivity, Precision, Linearity, Accuracy and Robustness	**3L**

References :

1. An Advance Dairy chemistry, V 3, P. F. Fox, P. L. H. McSweeney Springer Unit/s (3.1,3.2)
2. Analysis of food and Beverages, George Charalanbous, Academic press 1978 Unit/s (3.1,3.2)
3. Analytical Chemistry of Open Learning(ACOL),James W. Dodd and Kenneth H. Tonge Unit/s (4.1,4.2)
4. Analytical chemistry David Harvey The ,McGraw Hill Companies, Inc. Unit/s (4.1,4.2)
5. Analytical Chemistry, Gary.D Christan, 5th edition Unit/s (2.1,2.2)
6. Analytical chemistry, R. K. Dave. Unit/s (2.1,2.2)
7. Chemical methods of separation, J A Dean, Van Nostrand Reinhold,1969 Unit/s (2.1,2.2)
8. Egyankosh.ac.in/bitstream/123456789/43329/1/Unit-8 Unit/s (1.1,1.2,1.3)
9. Food Analysis, Edited by S. Suzanne Nielsen, Springer Unit/s (3.1,3.2)
10. Food Analysis: Theory and practice, YeshajahuPomeranz, Clifton E. Meloan, Springer Unit/s (3.1,3.2)
11. Formulation and Function of cosmetics, Sa Jellineck Unit/s (3.1,3.2)
12. Fundamentals of Analytical Chemistry, D .A. Skoog and D. M. West and F. J. Holler Holt., Saunders 6th Edition (1992) Unit/s (2.1,2.2)
13. Government of India publications of food drug cosmetic act and rules. Unit/s (3.1,3.2)

14. Harry"s Cosmetology, Longman scientific co. Unit/s (3.1,3.2)
15. High Performance Thin Layer Chromatography in Food analysis, by Prem kumar, CBS Publisher and distributer Unit/s (3.1,3.2)
16. Instrumental methods Of Analysis, by Willard Merritt Dean, 7thEdition, CBS Publisher and distribution Pvt Ltd Unit/s (1.1,1.2,1.3) (4.1,4.2,4.3)
17. Introduction to Polarography and Allied Techniques, By Kamala Zutshi, New Age International, 2006. Unit/s (1.1,1.2,1.3)
18. Modern cosmetics, E. Thomessen Wiley Inter science Unit/s (3.1,3.2) 19. Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman Unit/s (4.1,4.2,4.3)
19. Principles of Polarography by Jaroslav Heyrovský , Jaroslav Kůta, 1st Edition, Academic Press, eBook ISBN: 978148326478 Unit/s (1.1,1.2,1.3)
20. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969 Unit/s (2.1,2.2,)

Evaluation Pattern:

A) Continuous Evaluation (40%) : 40 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
Assignments / seminar / project / worksheets / class tests	15
Attendance and active participation in classroom	05
Total	**40**

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

Question Number	Unit	Marks
1	I	12
2	II	12
3	III	12
4	IV	12
5	I, II, III, IV	12

CIE/ Internal	SEE	Total Marks
40	60	100

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

Name of the Course	B.Sc
Course Code	**USCHP604**
Class	T.Y.B.Sc
Semester	VI
No of Credits	02
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	-------

COURSE CODE: USCHP604

Nomenclature: ANALYTICAL CHEMISTRY

Course Outcomes: On completion of this course the students will be able

CO1 Estimate chromium content in water sample using spectrophotometer.

CO2 Estimate reducing sugar in honey by Wilstatter method

CO3 Apply Ion exchange chromatographic method for separation of Mg^{+2} and Zn^{+2} ions.

CO4 determine % of Acetic acid in Vinegar sample by potentiometric method

CO5 Estimate amount of Phosphoric acid in Cola sample pH metrically.

Curriculum :

Unit	Title	Learning Points	No of Credits
Non-Instrumental	**Redox Titration**	Estimation of reducing sugar in honey by Willstatter method.	**02**
	Ion Exchange Chromatography	Estimation of Mg^{+2} and Zn^{+2} by anion exchange resin. using an anion exchange resin	
Instrumental	**Spectrophotometry**	Estimation of Chromium in water sample spectrophotometrically by using Diphenyl carbazide.	
	Potentiometry	Estimation of acetic acid in Vinegar sample by using Quinhydrone electrode potentiometrically.	
	pH metry	Determination of phosphoric acid in cola sample pH metrically.	

References:

1. Vogel‟s Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J Memdham and R C Denney, ELBS with Longmann (1989).
2. Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al
3. The chemical analysis of food and food products III edition Morris Jacob
4. The chemical analysis of food by David Pearson and Henry Edward

Evaluation Pattern: Practical Total Marks : 50

1. 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**

2. Semester End Examination: 60% (30 Marks)

Sr. No.	Title	Method	Marks
1.	Instrumental / Non instrumental experiment	Experiment performance as per the practical slip	40
2.	Viva Voce + Journal		05+ 05
Total			**50**

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

CIE / Internal	SEE	Total
20	**30**	**50**

Date: 4/11/2025

Chairperson BoS

Dr. M. L. Gore

R. P. Gogate College of Arts & Science and R. V. Jogalekar College of Commerce, (Autonomous) Ratnagiri 67 | Page