VANITA VISHRAM WOMEN'S UNIVERSITY

(Managed By: Vanita Vishram, Surat)

1st Women's University of Gujarat

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CHEMISTRY

B.Sc. Chemistry (Honors)

SYLLABUS

As per NEP-2020

w.e.f 2023-24

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1 PREAMBLE – VVWU

Vanita Vishram Women's University (VVWU) is the First-ever Women's University of Gujarat approved by the Government of Gujarat under the provisions of the Gujarat Private Universities Act, 2009. It is a University committed to achieve Women's Empowerment through Quality Education, Skill Development, and by providing employment opportunities to its girl students through its model curriculum, integration of technology in pedagogy and best-in-class infrastructure. The focus is on prioritizing practical component and experiential learning supported through academia-industry linkages, functional MoUs, skill development training, internships etc. It aims at providing opportunities to the girl students for holistic development and self-reliance.

VISION

Empowerment of women through quality education and skill development, so as to make them strong pillars of stability in the society.

MISSION

To provide Education & Professional Training to all women for their all-round development, so as to enable them to become economically independent and socially empowered citizens.

2 SALIENT FEATURES

- Based on NEP-2020 & CBCS
- Interdisciplinary as well as multidisciplinary.
- Practical-oriented, skill-based & vocation-based.
- Based on experiential learning.
- Greater exposure to internship, hands-on training, project work, field work, presentation etc.
- Mode of teaching shall be Offline.
- Qualified & Competent Faculty Members for effective teaching-learning
- Employment-Generating

3 INTRODUCTION OF THE PROGRAM

B.Sc. Chemistry Honors is a UG degree program designed to provide students with a comprehensive understanding of the fundamental principles and applications of chemistry. This undergraduate course offers a strong foundation in chemical theory, laboratory techniques and analytical skills necessary for a successful career in various scientific fields.

Students enrolled in this program will explore a wide range of topics, including organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry, biochemistry and environmental chemistry. Through hands-on laboratory experiments, students will gain practical experience in conducting chemical analyses, synthesizing compounds and interpreting experimental data.

The curriculum emphasizes critical thinking, problem-solving, and scientific inquiry. Students will develop a deep understanding of chemical concepts and their practical applications in areas such as pharmaceuticals, materials science, polymer science, dyes industries, environmental science, fermentation, food & dairy and forensics etc.

Upon completion of the program, students will be well-equipped to pursue careers in research and development, quality control, chemical analysis, teaching or further studies at the postgraduate level. The course opens doors to a wide range of exciting opportunities in both industry and academia, where chemists play a crucial role in advancing scientific knowledge and addressing real-world challenges.

4 PROGRAMME OBJECTIVES (POS)

PO 1. To impart knowledge of Chemical sciences and application of chemistry in day-to-day life.

PO 2. To strengthen the in-field practical knowledge of the students by providing them hands-on experimentation, project work and field work.

PO 3. To develop capability of thinking, understanding/analyzing and interpreting and solving problems to meet the need of industries such as pharmaceuticals, materials science, polymer science, dyes industries, environmental science, food & dairy, forensics, Academia, etc. and research.

PO 4. To make learners understand about ethical aspects, safety aspects and their responsibilities towards mankind and the environment.

PO 5. To make students capable of finding entrepreneurship opportunities for betterment of society, environment.

PO 6. To make the students avail of all the basic knowledge required for various competitive examinations related to the Sciences.

5 PROGRAM SPECIFIC OUTCOMES (PSOS)

Upon completion of the B.Sc. Chemistry/B.Sc. (Hons) Chemistry program, the students would:

PSO 1. Have the knowledge of basics of Chemistry and its understanding.

PSO 2. Be able to apply their practical skills and knowledge to identify and resolve the problems related to and serve various Chemical Industries such as pharmaceuticals, materials science, polymer science, dyes industries, environmental science, food & dairy etc.

PSO 3. This program fosters interdisciplinary learning habits, enabling students to utilize modern analytical tools and software for industry and research analysis.

PSO 4. Be able to cultivate professional ethics and equip students to pursue careers in various sectors as chemists, researchers, educators, managers, regulators and professionals in chemistry-related industries.

PSO 5. Develop high-quality research encouraging scientific thinking and approach for research.

PSO 6. Develop skills for further higher studies, competitive examinations and employment.

6 PROGRAM HIGHLIGHTS:

Course Level	UG						
Program	Bachelors in Science						
Duration	3 years (6 semesters)						
Examination Type	Semester system (1-6 semesters)						
Intake	40						
Eligibility	10 + 2 in Science stream with A, B or AB group						
Mapping between POs and PSOs		PSO 1.	PSO 2.	PSO 3.	PSO 4.	PSO 5.	PSO 6.
	PO 1.						
	PO 2.						
	PO 3.						
	PO 4.						
	PO 5.						
	PO 6.						
Job Positions	Scientist, Teacher, RnD Officials, QA/QC Executives in various sectors of Chemistry domain such as pharmaceuticals, materials science, polymer science, dyes industries, environmental science, forensics, Academia etc.						

7 Scheme of Assessment

Following is the scheme of assessment followed by the university –

Weightage (%)	Continuous Comprehensive Evaluation (CCE) (50%)	Semester End Evaluation (SEE) (50%)
100%	[Internal Exam] **(20%)** + [1. Assignments/ 2. Project work/ 3. Field work/ 4. Quiz/ 5. Group discussion/ 6. Role play/ 7. (Lab Record/ Lab Performance/ Lab work) / 8. (Seminar / Class Performance/ Poster Presentations) 9. Viva Voce/ 10. Book Review or Article Review/ 11. Case Studies/ 12. Class Test/ 13. Report Writing/ 14. Any Other as per the requirement of the subject] (Any Two) (Thread-01 + Thread-02) **(10% + 10%)** + [Attendance] **(10%)**	End Semester Examination (ESE) Theory/Practical Exams Whole Syllabus

8 Credit Structure

Proposed UG Credit structure for UG -2023								
According to Curriculum and Credit Framework for Undergraduate Programme								
Semester	**Major**	**Minor**	**Multi Disciplinary**	**Ability Enhancement Course (AEC)**	**Skill Enhancement Course (SEC)**	**Indian Knowledge System (IKS) /Value Added Courses(VAC)**	**RP/ OJT**	**Total**
1	8	4	4	2	2	2	0	22
2	8	4	4	2	2	2	0	22
3	12	0	4	2	2	2	0	22
4	12	4	0	0	2	2	0	22
5	12	8	0	2	2	0	0	22
6	12	4	0	0	4	0	0	22
Total	**64**	**24**	**12**	**10**	**14**	**8**	**0**	**132**
7	12	4	0	0	0	0	6	22
8	12	4	0	0	0	0	6	22
Total	**24**	**8**	**0**	**0**	**0**	**0**	**12**	**44**
Grand Total	**88**	**32**	**12**	**10**	**14**	**8**	**12**	**176**
* If anyone wants to exit after 2nd/ 4th Sem and wants a certificate/Diploma respectively, should complete an internship of 4 credits (60 hrs)								

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DEPARTMENT OF CHEMISTRY

B.Sc. CHEMISTRY

SEMESTER 2

SYLLABUS

AS PER NEP-2020

W.E.F 2023-24

9 Course Structure – Paper Titles SEMESTER 2

Proposed Integrated (UG) Course structure for year – 2023									
Sem	**Major**	**Minor**	**Multi-Disciplinary**	**Ability Enhancement Compulsory (AEC)**	**Skill Enhancement Course (SEC)**	**Indian Knowledge System / Value Added Courses (IKS/VAC)**	**Summer Internship/ Project/ Online Course**	**Dissertation**	**Total**
1	Major-I Inorganic & Physical Chemistry-II (Th)	Minor-I Fundamentals of Chemical Science-II	Offered by other Departments	Functional English-I	Analytical Tools & Techniques	Environmental Studies	-	-	07
	Major-II Organic Chemistry-II (Th)								

10 Teaching and Evaluation Scheme for BSc Chemistry academic year 2023-24

Semester	Course Code	Course Category	Course Title	Teaching Scheme				Examination Scheme													Total Credit
				Contact Hours			Total Credit	Theory						Practical							
								Credit	CCE		SEE			Credit	CCE		SEE			Total	
				Theory	Practical	Total			Max.	Passing	Max.	Passing	CCE+SEE Passing		Max.	Passing	Max.	Passing	CCE+SEE Passing		
II	CHM203-1C	Major	Inorganic & Physical Chemistry-II (Th)	3	0	3	3	3	35	13	35	13	26	0	0	0	0	0	0	70	4
			Inorganic & Physical Chemistry-II (Pr)	0	2	2	1	0	0	0	0	0	0	1	15	6	15	6	12	30	
	CHM204-1C	Major	Organic Chemistry-II (Th)	3	0	3	3	3	35	13	35	13	26	0	0	0	0	0	0	70	4
			Organic Chemistry-II (Pr)	0	2	2	1	0	0	0	0	0	0	1	15	6	15	6	12	30	
	CHE202-1C	Minor	Fundamentals of Chemical Science-II (Th)	3	0	3	3	3	35	13	35	13	26	0	0	0	0	0	0	70	4
			Fundamentals of Chemical Science-II (Pr)	0	2	2	1	0	0	0	0	0	0	1	15	6	15	6	12	30	
	BTE202-1C	Minor	Cell Biology (Th)	3	0	3	3	3	35	13	35	13	26	0	0	0	0	0	0	70	4
			Cell Biology (Pr)	0	2	2	1	0	0	0	0	0	0	1	15	6	15	6	12	30	

II	PHE202-1C	Minor	Fundamentals of Physics-II (Th)	3	0	3	3	3	35	13	35	13	26	0	0	0	0	0	0	70	
			Fundamentals of Physics-II (Pr)	0	2	2	1	0	0	0	0	0	0	1	15	6	15	6	12	30	
	MDC202-1C	Multi-Disciplinary	Interdisciplinary perspectives on the Indian Space Program (Th)	4	0	4	4	4	50	18	50	18	36	0	0	0	0	0	0	100	4
			Food Standards and Laws	4	0	4	4	4	50	18	50	18	36	0	0	0	0	0	0	100	
	AEC202-1C	AEC	Functional English-I	2	0	2	2	2	25	9	25	9	18	0	0	0	0	0	0	50	2
	SEC202-1C	SEC	Analytical Tools and Techniques	2	0	2	2	2	25	9	25	9	18	0	0	0	0	0	0	50	2
	VAC201-1C	VAC/IKS	Environmental Studies	2	0	2	2	2	25	9	25	9	18	0	0	0	0	0	0	50	2

11 SYLLABUS: SEMESTER 2

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Department of Chemistry
B.Sc. Chemistry Program
FY B.Sc. Semester II

CHM203-1C: INORGANIC & PHYSICAL CHEMISTRY-II (Major-I)

Credit 3 **Contact Hour per week: 3**

Outline of the Course:

Course type	Theory
Purpose of Course	The course aims to provide a foundation for understanding the basics of nucleophilic substitution and elimination reaction, concept of aromaticity and fundamentals of stereochemistry. It equips students with essential knowledge and skills necessary for further studies and applications in organic chemistry.
Course Objective	CO 1. Determine whether a particular solution is a strong electrolyte, weak electrolyte, or non-electrolyte by analyzing it. CO 2. Demonstrate the knowledge of the various solid state bonding contributions. Show that can predict a material's properties by connecting the crystalline structure and bonding. CO 3. To study the trends in the d-block elements' characteristics and reactivity, transition metals.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	August 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Class Room Teaching, Use of ICT, Class exercise, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Course Content:

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	**Electrolysis and Electrical Conductance :** Mechanism of electrolysis, Electrical units, Faraday's laws of Electrolysis, Faraday's first law, Faraday's second law, Importance of the first Law of electrolysis, Importance of the second Law of electrolysis, Conductance of Electrolytes, Specific conductance, Equivalent conductance, Molar conductance, Summary of Electrochemical Quantities, Strong electrolytes, Weak electrolytes Measurement of Electrolytic conductance, Determination of the cell Constant, Numericals	33 %	15
2	**Solid State:** Nature of the Solid State, Types of Solids, Isotropy and Anisotropy, The Habit of a Crystal,Law of Constancy of Interfacial Angles, Symmetry Of Crystals, Elementary Ideas of Symmetry, Symmetry elements, Miller indices, Crystal Structure, Unit Cells and Its Parameters, Calculation of Mass of The Unit Cell,Seven Crystal Systems and Fourteen Bravais Lattices; Coordination Number of a Crystal Lattice, X-Ray Diffraction, Bragg's Law	34 %	15
3	**d-Block chemistry:** general considerations, Ground state electronic configurations, Physical properties, Reactivity of the elemental metals, An overview of characteristic properties, Electroneutrality principle, the Kepert model, Coordination numbers, Isomerism	33 %	15

REFERENCE:

1. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
2. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
3. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
4. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
5. Inorganic Chemistry second edition by Catherine E. Housecroft and Alan G. Sharpe, Pearson, 2005.

COURSE OUTCOMES:

After completing the course, the students will be able to:

CO 1.	Basic concepts about electrolysis
CO 2.	Crystal structure of different ionic compounds
CO 3.	Understand properties of d block elements

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	Electrolysis and Electrical Conductance			
2	Solid State			
3	d-Block chemistry			

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

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FY B.Sc. Semester II

CHM204-1C: ORGANIC CHEMISTRY-II (Major-II)

Credit 3 **Contact Hour per week: 3**

Outline of the Course:

Course type	Theory
Purpose of Course	The course aims to provide a foundation for understanding the basics of nucleophilic substitution and elimination reaction, concept of aromaticity and fundamentals of stereochemistry. It equips students with essential knowledge and skills necessary for further studies and applications in organic chemistry.
Course Objective	CO 1. Learning the concepts and mechanism of nucleophilic substitution and elimination reaction. CO 2. Student can learn the concepts of aromaticity CO 3. To learn the synthesis and reactions of some heterocyclic compounds. CO 4. Study the basic concepts of stereochemistry of Organic Compounds.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	August 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Class Room Teaching, Use of ICT, Class exercise, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Course Content:

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	**a) Nucleophilic substitution Reactions** Nucleophilic substitution, Structure and stability of carbocations, The SN1, SN2, SET and SN1 mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl,vinyl and aryl halides towards nucleophilic substitution reactions. **b) Elimination Reactions** Types of Elimination Reactions E1; E2; E1cb; Ei,, Mechanism, Stereochemistry, Factor affecting in Elimination Reaction over Substitution Reaction: solvent, leaving group, temperature.	33 %	15
2	**Aromatic Compounds** **a) Aromaticity:** Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions and Electrophilic aromatic substitution:halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of substituent groups. **b) Aromatic Heterocycles:**Introduction to heterocycles and their importance. Nomenclature of ring systems: (a) Trivial System (b) Replacement system (c) Fusion system, (d) Hantzsch-Widman nomenclature, Structure, reactivity and synthesis of five membered Heterocycles with one heteroatom: (a) Pyrrole (b)Thiophene (c) Furan.	34 %	15
3	**Stereochemistry of Organic compounds:** Isomerism, Types of Isomerism, Difference between configuration and conformation: Fischer and flying wedge formula their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules, Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centers, Diastereoisomers, meso structures, Racemic mixtures, Relative and absolute configuration: D/L and R/S designations, resolution of enantiomers, inversion, retention and racemization.	33 %	15

REFERENCE:

1. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).
2. Organic Chemistry by Bahl & Bahl.
3. Text book of Organic Chemistry by P. S. Kalsi, 1999, MacMillan of India Pvt. Ltd.
4. Textbook of Organic chemistry by C. N. Pillai
5. Morrison, R. N. & Boyd, R. N. Organic Chemistry, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

6. Stereochemistry of Organic Compounds: Principles and applications by D. Nasipuri, New Age International Publisher.
7. Topics in Heterocyclic Chemistry. G. W. Gribble. Springer-Verlag Berlin Heidelberg, 2010.
8. Modern Heterocyclic Chemistry. 4 Volume Set. Julio Alvarez-Builla, Juan Jose Vaquero, José Barluenga. Wiley. 2011.

COURSE OUTCOMES:

Upon successful completion of the course,

CO 1.	Students will be able to study basic concepts and basic principles about organic compounds, organic reactions with mechanisms.
CO 2.	Students will be able to understand carbon-carbon bond formation reactions and its importance in organic chemistry.
CO 3.	Students will be able to learn the concepts of organic qualitative and quantitative analysis performed in the laboratory via theory.

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	a) Nucleophilic substitution Reactions b) Elimination Reactions			
2	Aromatic Compounds			
3	Stereochemistry of organic compounds			

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

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Credit 2 **Contact Hour per week 4**

Outline of the Course:

Course type	Practical
Purpose of Course	The course aims to provide a foundation for understanding the fundamental principles, properties, and reactions of elements of unknown compounds. It equips students with essential knowledge and skills necessary for further studies and applications in chemistry.
Course Objective	CO 1. Able to perform Organic qualitative analysis of single substances with various functional groups with to perform melting point and boiling point detection. CO 2. To learn the accuracy and precision in volumetric titration.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	August 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Laboratory work, Hand on Training, Discussion and Journal Writing
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Course Content:

Units	Particulars
1	**INORGANIC QUALITATIVE ANALYSIS (Inorganic qualitative analysis of single salt)** **N. B. Candidates should perform the analysis of at least 6 compounds.**
2	**Organic Estimations:** 1. Estimation of Amide. 2. Estimation of Aniline.
3	**Paper Chromatography of binary mixture of amino acids.**
REFERENCE: 1. Quantitative analysis by R.A. Day and A.L. Underwood. 2. Vogel's qualitative inorganic analysis. 3. Elementary Practical Organic Chemistry Part-III Quantitative Organic Analysis by A. I. Vogel.	

COURSE OUTCOMES:

Upon successful completion of the course,

CO 1.	Students will be able to identify unknown inorganic substances.
CO 2.	Students will be able to understand chemical reaction behind the analysis
CO 3.	Students will be able to estimate some organic molecules like amide and aniline.
CO 4.	Students will be able to learn the concepts about separation techniques like paper chromatography.

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes			
		CO 1	CO 2	CO 3	CO 4
1	**Inorganic Qualitative Analysis**				
2	**Organic Estimations**				
3	**Paper Chromatography**				

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						

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Semester II

CHE202-1C: FUNDAMENTALS OF CHEMICAL SCIENCE-II (Minor-II)

Credit 3 **Contact Hour per week: 3**

Outline of the Course:

Course type	Theory
Purpose of Course	The course aims to provide a foundation for understanding the fundamental principles, properties, and reactions of elements and compounds. It equips students with essential knowledge and skills necessary for further studies and applications in chemistry.
Course Objective	CO 1. Learning of Basics of organic molecules, structure, bonding, hybridization and geometry of atoms reactivity and organic acid and bases with their strength. CO 2. Understanding general principles of Organic reactions mechanism, Electrophile, nucleophiles. CO 3. Analyse kinetics of chemical reaction study from a scientific perspective. Apply and recognize fundamental chemical engineering concepts. Apply heterogeneous catalytic chemical kinetics concepts.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	August 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Class Room Teaching, Use of ICT, Class exercise, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Course Content:

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	**Basics of Organic Chemistry:** Classification, and Systematic IUPAC Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyper conjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.	33 %	15
2	**Basic Organic Reactions** Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophilic Reactions: Electrophiles, E1, E2, E1Cb and Ei. Nucleophilic substitution: Nucleophiles, SN1, SN2, SNi and NGP mechanisms.	34 %	15
3	**Chemical Kinetics :** Chemical kinetics and its scope, Reaction rate, Average rate of reaction is a function of time, Instantaneous rate of reaction, Rate laws, Order of a reaction, Molecularity of a reaction, Molecularity of a reaction of (a) Elementary reactions and (b) Complex reactions, molecularity versus order of reaction, Pseudo–order reactions, Zero order reactions, First order reactions, Examples of first order reactions, Numericals	33 %	15

REFERENCE:

1. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).
2. Organic Chemistry by Bahl & Bahl.
3. Text book of Organic Chemistry by P. S. Kalsi, 1999, MacMillan of India Pvt. Ltd.
4. Textbook of Organic chemistry by C. N. Pillai
5. Organic Chemistry, Morrison Boyd & Bhattacharjee,7th Edition, Pearson, 2010.
6. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub: S. Chand

COURSE OUTCOMES:

Upon successful completion of the course,

CO 1.	Use the fundamental principles of organic nomenclature to translate between different structures and names. The reagents produce the outcomes of a specified group of organic reactions.
CO 2.	Fundamental knowledge of organic reactions and its use in chemical transformation.
CO 3.	Understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured.

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	Basics of Organic Chemistry			
2	Basic Organic Reactions			
3	Chemical Kinetics			

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

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CHE202-1C: Fundamentals of Chemical Science-II

Credit 1 **Contact Hour per week: 2**

Outline of the Course:

Course type	Practical
Purpose of Course	The course aims to provide a foundation for understanding the fundamental principles, properties, and reactions of elements and compounds. It equips students with essential knowledge and skills necessary for further studies and applications in chemistry.
Course Objective	CO 4.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	August 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Class Room Teaching, Use of ICT, Class exercise, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Course Content:

Units	Particulars
1	**Organic Spotting**: Primary tests, Ignition test, Detection of Elements, Nature of the substance (solubility test), Functional group tests, C. T., Molecular formula and Structural formula of the given substance. **N. B. Candidates should perform the analysis of at least 4 compounds.**
2	**Organic Estimations:** 1. Estimation of Amide. 2. Estimation of Aniline.
REFERENCE:	
1. Quantitative analysis by R.A. Day and A.L. Underwood. 2. Vogel's qualitative organic analysis. 3. Elementary Practical Organic Chemistry Part-I Small Scale Preparations by A. I. Vogel. 4. Elementary Practical Organic Chemistry Part-III Quantitative Organic Analysis by A. I. Vogel.	

COURSE OUTCOMES:

Upon successful completion of the course,

CO 5.	Students will be able to identify unknown inorganic substances.
CO 6.	Students will be able to understand chemical reaction behind the analysis
CO 7.	Students will be able to estimate some organic molecules like amide and aniline.

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	Organic Spotting			
2	Organic Estimations			

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						

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SEC202-1C: SEC : Analytical Tools and Techniques

Credit 2 **Contact Hour per week: 2**

Outline of the Course:

Course type	Theory
Purpose of Course	The course aims to provide a foundation for understanding the fundamental principles,construction and working of laboratory instruments. It equips students with essential skills to operate the instrument with better understanding.
Course Objective	CO 1. Learning the principle of laboratory instruments CO 2. Learning the working mechanism of an instrument provides better accessibility to operate instruments. CO 3. Learning the basic application and uses of a variety of instruments provides a range of application knowledge . CO 4. Understanding operation, care and maintenance of laboratory techniques and instrument handling,
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	July 2023
Pre-requisite	Elementary knowledge of Chemistry
Teaching Methodology	Class Room Teaching, Use of ICT, Class exercise, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	**Separation Techniques** Introduction, Basic Principles of Chromatography Partition Chromatography, Paper Chromatography, Thin layer Chromatography, Column Chromatography, Gel filtration Chromatography, Ion exchange Chromatography, Gas Chromatography, High Performance Liquid Chromatography, Fast protein liquid Chromatography	50%	**15**
2	**Spectroscopy** Introduction, The electromagnetic spectrum and its usage for spectroscopic methods, General Principles, Beer–Lambert's Law, Mechanics of Measurement, UV–Visible Spectroscopy, Definition, Principle, Instrumentation, Analysis of biomolecules using UV and visible range.	50 %	**15**

REFERENCE:

1. Principles and Techniques of Biochemistry and Molecular Biology Seventh edition by Keith Wilson And John Walker
2. Introduction to Instrumentation in Life Sciences by Prakash Bisen and Anjana Sharma
3. Chromatography And Separation Science By Satindra Ahuja
4. Instrumental Methods of Chemical Analysis by B.K. Sharma
5. Principle of Instrumental Analysis by Skoog, Holler and Crouch.

COURSE OUTCOMES:

Upon successful completion of the course,

CO 1.	Students will have an enhanced knowledge of separation techniques.
CO 2.	Students will be able to study the structure through spectroscopy.

COURSE OUTCOMES MAPPING

Unit No.	Title of the Unit	Course Outcomes	
		CO 1	CO 2
1	**Separation Techniques**		
2	**Spectroscopy**		

COURSE ARTICULATION MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						

12 Teaching Methodology

A teaching method comprises the principles and methods used by teachers to enable student learning. In order to achieve its objective of focused process- based learning and holistic development, the teacher/faculty may use a variety of knowledge delivery methods:

12.1 Lectures/Class works:

Lectures should be designed to provide the learners with interesting and fresh perspectives on the subject matter. Lectures should be interactive in a way that students work with their teachers to get new insights in the subject area, on which they can build their own bridges to higher learning. Classwork has the ability to enhance relationships between teachers and students. Create goal- oriented tasks for students to prepare and enable self-learning.

12.2 Discussions/ Seminars/Presentation:

Discussions / seminars / presentation are critical components of learning and can be used as a platform for students to be creative and critical with old and new ideas. Besides developing critiquing skills, arriving at consensus on various real-life issues and discussion groups lead to innovative problem-solving and ultimately to success.

12.3 Case Studies/ Self-Study:

Real case studies, wherever possible, should be encouraged in order to challenge students to find creative solutions to complex problems of individual, community, society and various aspects of the knowledge domain concerned. Technology is transforming higher Education learning and teaching through various case studies to improve overall standards.

12.4 Practical/Problem sheet:

Practical ability is the essential requirement for computer science undergraduates' ability structure, and it emphasizes that computer science undergraduates should have a good grasp of theory from practice and then apply the theory to practice, improving them own software developing skills and employability.

12.5 Assignments:

Computer science assignments not only help students overcome their fear and stress but also help them learn more interesting facts about the subjects of computer science which are part of their syllabus and also out of curriculum.

12.6 Industrial Tours:

Computer Science students have to know the things practically through interaction, working methods and employment practices. Moreover, it gives exposure from an academic point of view. Main aim of the industrial visit is to provide an exposure to students about the practical working environment.

12.7 Team Work:

Teamwork based projects challenge the student to apply the technical knowledge they gain in college to solve meaningful and complex problems. Positive collaboration in the form of team work is critical in the classroom environment, for which it is necessary to transcend one’s prejudices and predilections so as to achieve the desired outcomes. In the process of

team work, learners will acquire the skills of managing knowledge acquisition and other collaborative learners, thereby understanding how to incorporate and balance personalities.

13 KEYWORDS

- Bachelor of Science (B.Sc.) in Chemistry
- Organic Reaction
- Nucleophilic Substitution Reaction
- Elimination Reaction
- Stereochemistry
- Qualitative analysis
- Quantitative analysis
- Separation Techniques
- Spectroscopy