

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science & Humanities



**Structure, Teaching Scheme and Syllabus of
B.Sc. (Honours) Chemistry Sem-3 as per NEP-2020**

Program Code: SC104

Semester- IV

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Organic Chemistry-III
Course Code:	13-CHM205-2C
Pre-requisite Course:	Basic Chemistry up to F.Y. B.Sc.

Course Objectives:

1. To develop the fundamental analytical and industrial skills to work effectively in the different fields of chemistry.
2. Learn the basic concepts of aromaticity and electrophilic aromatic substitution.
3. Learn the fundamentals of amino acids.
4. Learn and understand concepts of active methylene compounds.
5. Learn and perform the separation of binary water insoluble organic solid-solid component mixture.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	2	4	50	25	-	25	100

Course Contents:

Unit	Topic	Total Hours	Weightage (%)
1	Aromaticity Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Aromaticity in benzenoid and non-benzenoid compounds and charged rings, annulenes, fulvenes, azulenes, antiaromaticity and homoaromaticity.	15	34
2	Amino acids Introduction, Classification and nomenclature, Dipolar ion structure and Isoelectric point, Synthesis of amino acids (Gabriel Phthalimide, Straker, Fisher malonic ester), Reactions of amino acid.	15	33
3	Active methylene group compounds Introduction of tautomerism, Determination of keto-enol tautomerism, Difference between tautomerism and resonance, Synthesis and application of ethyl acetoacetate and malonic ester.	15	33

Reference Books:

1. Organic reaction and mechanism, P.S.Kalsi, New Age international Publishers.
2. Organic Chemistry Vol. I & II, S.M.Mukherji, S.P.Singh, R.P.Kapoor.
3. Reaction mechanism in Organic Chemistry, S.M.Mukhergi, S.P.Singh. 3rd edn, Macmillan.
4. Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4th edn, Himalaya Publication House.
5. Organic Chemistry, T.W. GrahamSolomons, 4th edn, John Wiley, 1998.

List of Open-Source Software/learning website:

1. <https://www.organic-chemistry.org>
2. <https://swayam.gov.in>
3. <https://nptel.ac.in>
4. <http://onlinelibrary.wiley.com>
5. https://en.wikipedia.org/wiki/Main_Page

List of Experiments:

Sr. No	Practical Exercise
1.	Separation of binary water insoluble organic solid-solid component mixture (Any 5 solid-solid mixture)

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn and understand about Huckel's rule for aromatic compounds and electrophilic aromatic substitution reactions	1-Remembering 2-Understanding
CLO2	Learn and understand the fundamentals of amino acids	1-Remembering 2-Understanding
CLO3	Learn and understand the basic concepts of active methylene group compounds	1-Remembering 2-Understanding
CLO4	Learn, understand and perform the separation of binary water insoluble organic solid-solid component mixture.	2-Understanding 3-Applying

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	2																2	
CLO2		1			3							2						1
CLO3								2										
CLO4			2								1							

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Inorganic Chemistry-III
Course Code:	13-CHM206-2C
Pre-requisite Course:	Basic fundamental of Inorganic chemistry

Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about different terms use in Inorganic chemistry.
3. To develop an actual understanding of metals and metallic properties.
4. To learn about the history and classification magnetism.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	2	4	50	25	-	25	100

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Metal and Metallurgy Occurrence of Metals, Various steps involved in metallurgical processes, Concentration of ore, Calcination, roasting, Reduction of free Metal, Extraction of Zinc, Extraction of Copper, Extraction of Nickel.	15	33
2	Boron Hydrides: Introduction, Classification, Preparation, properties, structures and use of Diboranes, Bridge bonding in B ₂ H ₆ (M.O. and sp ³ approach.), Structure of higher Boranes: B ₄ H ₁₀ , B ₅ H ₉ , B ₅ H ₁₁ , B ₆ H ₁₀ , B ₁₀ H ₁₄ .	15	33
3	(A)Magnetic properties of Complexes: Type of magnetic behavior, Method of determining magnetic susceptibility, Spin Formula, Magnetic properties for 3 rd metal complexes. (B) Application of Crystal field theory: 1) For determination of color of complex, and 2) Use of C.F.S.E. value, Crystal field theory and it's limitation, Isomerism in complexes.	15	34

Reference Books:

Inorganic Chemistry

1. Principles of Inorganic chemistry by B.R.Puri, L.R.Sharma and K.C.Kalia.
2. Inorganic Chemistry by Dr.R.L.Madan, G.D.Tuli.
3. Selected Topics in Inorganic Chemistry by Wahid V. Malik,Tuli,Madan.

List of Open-Source Software/learning website:

1. <https://swayam.gov.in>
2. <https://nptel.ac.in>
3. <http://onlinelibrary.wiley.com>
4. https://en.wikipedia.org/wiki/Main_Page

List of Experiments:

Sr. No.	Practical Exercise
•	Volumetric Analysis of Cu, Zn, Ni, Ca
1	To determine the amount of Zn by EDTA Method.
2	To determine the amount of Ni by EDTA Method.
3	To determine the amount of Cu by Iodometry Method.
4	To determine the amount of Cu by EDTA titration.
5	To determine the amount of Ca by EDTA titration.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understanding the occurrence and extraction of metals.	1-Remembering 2-Understanding
CLO2	Understanding the structures and properties of Boron hydrides.	1-Remembering 2-Understanding
CLO3	Learn magnetic properties of complexes.	2-Understanding
CLO4	Understand basic concept of C.F.T and their applications.	2-Understanding 3-Applying
CLO5	Understand different type of volumetric titrations.	2-Understanding 3-Applying

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	1			2													2	1
CLO2		2			3		1										2	
CLO3				3													3	2
CLO4			2					2									3	1
CLO5		1															2	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Physical Chemistry-III
Course Code:	13-CHM207-2C
Pre-requisite Course:	Basic fundamental of Physical chemistry

Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about different terms use in physical chemistry.
3. To develop an actual understanding of acid-base and conductometric titrations.
4. To learn about the history and classification of Solid State.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	2	4	50	25	-	25	100

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Solid State Solid and their classification, Points of Difference between Crystalline and Amorphous solids, Classification of Crystalline solids, Space lattice and Unit cells, Crystal structures of Sodium Chloride, Cesium Chloride, Zinc blende, CaF_2 , Na_2O , Packing of Particles, Body-centered Cubic Structure, Tetrahedral and Octahedral voids, Co-ordination Number, Imperfections in Solids: Stoichiometric defect, impurity defect and Non- Stoichiometric defect.	15	34
2	Phase Rule Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs, Phase Rule: Merits and limitations. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver and $\text{FeCl}_3\text{-H}_2\text{O}$ only).	15	33
3	Ionic Equilibrium: Introduction, Electrolysis, Ionic Equilibrium, Resistance, Conductance, • Specific conductance, Equivalent Conductance, Molar Conductance, Equivalent Conductance at Infinite Dilution, Type of Conductometric Titration. Acid-Base Titration. 1) Strong Acid Vs Strong Base. 2) Strong Acid Vs Weak Base 3) Weak Acid Vs Strong Base 4) Weak Acid Vs Weak Base 5) Strong Acid + Weak Acid Vs Strong Base. Transport number. • Determination of Transport Number. • 1) Hittorf's Method. 2) Moving Boundary Method.	15	33

Reference Books:**Physical Chemistry**

1. Chemical Thermodynamics by R.P.Rastogi and R.R.Misra.
2. Advance Physical Chemistry by Gurdeep Raj
3. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully,S.Chand.
4. Principal of Physical Chemistry by Puri, Sharma,Pathania.

List of Open-Source Software/learning website:

1. <https://www.physicsclassroom.com/class>
2. <https://swayam.gov.in>
3. <https://nptel.ac.in>
4. <http://onlinelibrary.wiley.com>
5. https://en.wikipedia.org/wiki/Main_Page

List of Experiments:

Sr. No.	Practical Exercise
1.	Conductometric titration: i) HCl Vs. NaOH ii) HCl Vs. NH ₄ OH
2.	pH-metric titration- Callibration of pH-meter by 4- pH buffer i) HCl Vs. NaOH ii) HCl Vs. NH ₄ OH
3	Colorimeter: To determine the concentration of unknown solution from given KMnO ₄ solution by Colorimetry
4	Refractometer: Determine the specific refraction and molar refraction of the given liquid A, B and mixture C (A+B) and calculate the percentage composition of A and B in the mixture C by Abbe's Refractometer.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understanding the crystalline structure of the molecules.	1-Remembering 2-Understanding
CLO2	Understanding the defects of the crystalline structures of molecules.	1-Remembering 2-Understanding
CLO3	Learn phases and components of the different systems.	2-Understanding
CLO4	Understand ionic equilibrium and conductance.	2-Understanding 3-Applying
CLO5	Understand different type of titrations.	2-Understanding 3-Applying

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	1			2													2	3
CLO2		2					1										3	
CLO3				3													2	3
CLO4								2									3	2
CLO5		1															2	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Material Physics and Quantum Mechanics
Course Code:	13-MDC234-2C
Pre-requisite Course:	

Course Objectives:

1. To understand the basic concept of atomic cohesion and crystal binding
2. To understand the kinetic theory of gases
3. To understand the Basic concepts of Quantum Mechanics

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject contents:

Unit	Content	Total Hour	Weightage (%)
1	Quantum Theory: Historical origin of quantum theory, difficulties with classical: models, optical spectra Black body radiation, frank-Hertz experiment, stationary states of atoms. The correspondence principal. Bohr atom, Spectroscopic series, quantization of the orbits. The elliptic orbits, Particle in a box, rigid rotator, harmonic oscillator, short coming of a old quantum theory, Compton effect, Particle diffraction, wave packets and Einstein debrogle relation	15	33
2	Atomic Cohesion and Crystal Binding: Cohesion of Atoms, Primary Bonds, The Covalent Bond, The Metallic Bond, The Ionic Bond, Mixed Bond, Secondary Bonds, The Vander wall's Bond, The Hydrogen Bond, The Cohesive Energy, Ionic Crystal, Noble Gas Crystal, Atomic Radii vs Lattice constants, Elastic constants of crystals, Elastic Stress, Elastic Energy density, Application to Cubic crystal, Bulk modulus and compressibility.	15	33
3	Heat and Thermodynamics: Reversible part of the second law (Clausius theorem), Entropy, entropy of the ideal gas, TS diagram, application of the entropy of ideal gas, TS diagram, Application of the Entropy Principle. Pure substances: Volume expansivity: cubic Expansion Coefficient, Compressibility, Mathematical methods in thermodynamics: Characteristics Functions, Enthalpy, Helmholtz & Gibbs functions, two mathematical theorems, Maxwell relations, Tds equation, Internal energy equations, Heat energy equations, Heat capacity equations. Open system: Joule-Thomson expansion, Liquefaction of gases by the Joule Thomson Expansion.	15	34

Basic Reference book:

1. Introduction to solid state physics by C.Kittel (John Wiley)
2. Elements of solid state State Physics J. Prasad
3. Thermodynamics and Statistical Physics by Singhal, Agarwal and Prakash.
4. Physics- 301 semester 3 Nirav Prakashan

Physics Practical:

1. Coaxial Viscometer
2. To determine wave length of bright lines of mercury light Using Grating
3. R.P. of telescope
4. SearlsGonometer. Determination of cardinals Points and “do”
5. To Determine the high Resistance by equal method
6. To study bandwith response of R C coupled commom emitter (CE) Amplifier
7. Absolute Value of Capacity using B.G or S.G (spot Galvanometer)
8. To study elliptically polarized light using photo cell and quarter wave (Length) Plate

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=8jpqPu59edI&list=PL88pFy>
2. <https://www.youtube.com/watch?v=2WPA1L9uJqo>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the knowledge on the cohesion of atoms and crystal binding	1 Remembering
CLO2	Discuss quantum theory.	2 Understanding
CLO3	Solve the numerical related on internal energy of an ideal gas depends on its temperature.	3 Applying
CLO4	Explain the Heat and thermodynamics.	4 analyzing
CLO5	Justify the Joule Thomson Expansion.	5 evaluating
CLO6	Design the refrigerator on the base of thermodynamics.	6 creating

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2																
CLO2			1															
CLO3					3													
CLO4					2													
CLO5		1																
CLO6										2								

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Bioinstrumentation
Course Code:	13-MDC235-2C
Pre-requisite Course:	-

Course Objectives:

1. To enable students to acquire basic knowledge of instruments
2. To understand techniques related to analysis of processes & products
3. To understand separation procedures routinely used in biotechnology laboratories and industries.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject Contents:

Unit	Content	Total Hours	Weightage (%)
1	Spectroscopy - Interaction of EM radiation with matter: Overview of Electromagnetic spectrum; physical phenomenon: Absorption, Resonance fluorescence, Emission, Refraction, Diffraction, Scattering, Raman Scattering, Resonance Raman Scattering, Beer-Lambert's Laws. - UV-Vis spectrophotometer: Principle, Instrumentation, working and Application - Atomic spectroscopy: Principles and application of Atomic - Absorption/Emission Spectrometer	11	25
2	Chromatography - Chromatography: Basic Theory of Chromatography, Partition theory and solvent extraction theory - Introduction to key terms: retention time, retardation factor (R_f), elution - Partition and adsorption chromatography - Different techniques of chromatography: Principle, stationary and Mobile phase, operation, Detection/elution of solute, Application - Planner - Chromatography, (Paper Chromatography, TLC), GC, Ion exchange - chromatography, Gel exclusion chromatography, Affinity chromatography, HPLC and FPLC.	16	35
3	Electrophoresis: - Theory & principle of electrophoresis - Agarose electrophoresis of nucleic acid - Electrophoresis of protein- polyacrylamide gel (native and SDS-	18	40

	PAGE), Iso-electric focusing of protein • Overview of 2D Gel Electrophoresis Centrifugation: • Theory of centrifugation and sedimentation, • use and design of different types of rotors • Types of centrifuges: Preparative and analytical centrifugation • Density gradient centrifugation (zonal and isopycnic), differential Centrifugation, Application of centrifugation for preparative and analytical purpose.		
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Text Books:

- Principles and techniques of biochemistry & molecular biology by Keith Wilson & John Walker
- Biophysical chemistry: Principle and techniques by Upadhyay & Nath

Reference Books:

- Instrumental methods of analysis by B. Sivasankar
- Instrumental methods of analysis by Willard, Merritt, Dean & Settle
- Instrumental analysis by D.A. Skoog, Holler & Crouch
- Physical Biochemistry by David Freifelder
- Instrumental Methods of Chemical Analysis by Chatwal Gand Anand, S.
- Chemical analysis and instrumentation by B.k. Sharma

List of Open Source Software/learning website:

https://www.youtube.com/watch?v=KEXWd3_fM94

<https://study.com/learn/lesson/spectroscope-diagram-parts-function.html>

List of Experiments:

Principles of Colorimetry

1. Verification of Beer's law
2. To determine maximum absorption spectra of colored solution.

Chromatography

3. Solvent-solvent extraction of plant pigments
4. Use of paper chromatography for separation of plant pigments
5. Separation of Amino acids by paper chromatography.
6. TLC of Amino acids
7. Demonstration of Ion-exchange chromatography
8. Demonstration of Gel-exclusion chromatography
9. Centrifugation: Preparation of the sub-cellular fractions

Electrophoresis

10. Native gel electrophoresis of proteins
11. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explanation of various analytical techniques like Spectroscopy, chromatography, electrophoresis and centrifugation.	2 Understanding
CLO2	Use of centrifugation techniques in laboratories, industries and research centers.	3 Applying
CLO3	Use of Beer's law and maximum absorption spectra for quantitative estimation of sample.	3 Applying
CLO4	Use of paper chromatography for separation of plant pigments and Amino acids.	3 Applying
CLO5	Explanation of different Electrophoresis techniques.	4 Analysing
CLO6	Enabling the students to design & standardize various analyses, processes and separation techniques.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	2	2	3	3		2	3	1		1	1	3	1					
CLO2	2	3		2	2	2	2	3	2		2	1		1	1	1		
CLO3		2	3			2	2		1	3		3	3					
CLO4	3	3					3	2	3		2	1	1	2	1	2		
CLO5	3	2	2	2	3	2	2			2	1	2						
CLO6	2	1	2	1	2	1		2			2		1	3	2		1	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Grammar and Communication Skill-1
Course Code:	13-AEC203-2C
Pre-requisite Course:	Basics English Grammar Basics English up to F.Y.B.Sc.

Course Objectives:

1. To inculcate human values among the students through poems and prose.
2. To create an interest in literature and to develop language skills.
3. The students will become familiar with formal vocabulary that is common in academic texts.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Unit	Content	Total Hours	Weightage (%)
1	VOCABULARY&GRAMMARLINK Phrasal Verbs, Antonyms, Synonyms, Misspelled Words , Part Of Speech:- Noun, Pronoun, Verb, Adverb, Articles :- A, An ,The etc.	9	30
2	SPEAKING Dialogues Writing: - 1.A dialogue between a doctor and a patient 2.A dialogue between a teacher and a student about studies 3.A dialogue between a country child and a town child 4.A dialogue between mother and daughter about studies 5.A dialogue between a shopkeeper and a customer 6.A dialogue between a traffic warden and a taxi driver 7.A dialogue between the two friends about the choice of profession	6	20
3	READING&WRITING Letter writing (Personal & Business Letters) and invitations, Telegrams and notices, Paragraph Writing. Translation: - Translate the Accident/Incident Paragraphs given by your teacher from the English News Papers (Teacher has to give small paragraphs at least 5 to 6 paragraphs or more than that for the entire semester based on especially from the pages no. 3 & 4 of The Times of India)	6	20
4	TEXT Glimpses of Life-An Anthology of Short Stories (Orient Black Swan) Lesson 3 to 7	9	30

Text Books:

1. Glimpses of Life-An Anthology of Short Stories (Orient Black Swan)
2. Easy to learn English grammar by Dr.Jayesh Patel

Reference Books:

1. Very Useful Verbs book (Enka Publication)
2. Contemporary English Grammar Structure & Composition

3. Murphy R. Intermediate English Grammar (New Delhi: Cambridge University)
4. The Art of Public Speaking by Vijay Kumar.
5. The Times of India/The Indian Express
6. Business Correspondence and Report Writing by R.C Sharma & Krishna Mohan.

List of Open Source Software/learning website:

1. englishpage.com
2. epaper.timesofindia.com
3. epaperindianexpress.com
4. <https://www.youtube.com/watch?v=QdAgyD4xhY>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe how public speaking can be used to advocate or create change	1 Remembering
CLO2	Explain the goals and benefits of public speaking	2 Understanding
CLO3	Use parallel structures correctly and effectively.	3 Applying
CLO4	Identify strategies for researching and supporting a speech	4 Analyzing
CLO5	Recognize when to use visual aids	3 Applying
CLO6	Describe how public speaking can be used to advocate or create change	6 Creating

Mapping of CLOs with Pos& PSOs:

Course Learning Outcomes	Programme Outcomes(POs)																Programme Specific Outcome(PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	2					3					2					3		
CLO2		1			2		1			3		1			2			
CLO3			3					2					2			2		
CLO4		2					2					2						1
CLO5					2					2					2			
CLO6	1					1					1					2		

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Vacuum Pump, Pressure Gauge and Instruments
Course Code:	13-SEC210-2C
Pre-requisite Course:	Basic concept of instruments used in laboratory.

Course Objectives:

1. To Develop and actual understanding about various Instruments
2. To Know the Basic Application of Instruments
3. To Know the working of electrical instruments in Laboratory

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	-	-	50

Subject Contents:

Unit	Content	Total Hours	Weightage (%)
1	Vacuum Pumps, Pressure Guages: Exhaust Pumps and their characteristics, Rotary Oil Pumps, Molecular Pump, Diffusion Pump, Other methods of Producing Low Pressures, Pressure Gauges - McLeod Gauge, Pirani Gauge, Thermocouple Gauge, Ionization Gauge, Errors in measurement: Errors of observations, Types of errors, Normal law of errors, Average, standard and probable errors, Percentage error.	15	50
2	Instrument: Travelling Microscope, Cathetometer, and Optical bench. Objective and Eyepiece, Kellner's Eyepiece, Huygens Eyepiece, Ramsden Eyepiece, Comparission of Ramsden Eyepiece and Huygens Eyepiece, Gauss Eyepiece, Telescopes, Refracting Astronomical Telescope, Reflecting Telescope, Newton's Telescope, Other reflecting Telescopes. Electrical Instruments: Moving coil Galvanometer, Ballistic Galvanometer, Calibration of Ballistic Galvanometer using different methods, Multimeters, Digital multimeter, Earphone and Headphone. Basic Reference	15	50

Reference Books:

1. An Advanced Course in Practical Physics by D.Chattopadhyay, P.C. Rakshit, B.SAHA, New Central Book Ltd.
2. A text book of OPTICS by Dr. N, Subrahmanyam, Brijlal, Dr, M,N, Avadhanulu S.Chand.
3. Mechanics by D.S. Mathur S.Chand. (For Vacuum pumps)

List of Open Source Software/learning website:

1. <https://youtu.be/1OI-O1UcqoM>
2. <https://youtu.be/MmlpgjuMRjY>
3. <https://youtu.be/YIUHndbwnZE>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the vacuum pumps and pressure gauge.	1 Remembering
CLO2	Discuss the various optical instruments used in practicals	2 Understanding
CLO3	Solve the errors in measurements.	3 Applying
CLO4	Explain various meters used in practicals.	4 Analyzing
CLO5	Justify the usage of various galvanometers in practicals.	5 Evaluating
CLO6	Design various vacuum pumps.	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome(PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1		2																
CLO2			1															2
CLO3	3																1	
CLO4			2														1	1
CLO5			2															
CLO6			3															

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Business Mathematics-III
Course Code:	13-SEC211-2C
Pre-requisite Course:	

Course Objectives:

1. To understand the concept of Logic and Set Theory.
2. To understand the basic concept of Permutation and Combinations.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Unit	Content	Total Hours	Weightage (%)
1	Logic: [only examples] Logical Statements, Truth table, Negation, Compound statements, Tautologies and Contradiction, Negation of Compound statements, Propositions, Conditional and Biconditional statements. Set Theory: [only examples] Definition and methods of sets, types of sets, Venn diagrams, Operations on sets, De-Morgan's law, Finite and infinite sets.	15	50
2	Permutations and Combinations:[only examples] Fundamental rules of counting, Definition of Permutations and Permutation of n different things, Permutation of repeated things, Circular Permutation, Definition of Combination standard results and examples.	15	50

Text Books:

1. HSC, Gujarat State Board.

Reference Books:

1. Business Mathematics by. D.C.Sancheti & V.K.Kapoor, Sultan Chad & Sons Publication, New Delhi.
2. Business Mathematics by. B.S.Shah Prakashsan, Ahmedabad.

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=6kYngPvoGxU>
2. <https://www.youtube.com/watch?v=tnF9f3zCCKI>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain basic concept of Logic.	2 Understanding
CLO2	Discuss basic concept of Set Theory.	2 Understanding
CLO3	Solve example depend on Permutations.	3 Applying
CLO4	Describe Combinations.	1 Remembering
CLO5	Discuss Logical Statement and solve example of its.	2 Understanding 3 Applying
CLO6	Explain Circular Permutations.	4 Analyzing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	1	2	1		1	1	1	1		1							1	
CLO2	1	1	2		1		1			1	1					1		
CLO3	1	2	1		1								1					
CLO4	1	1	1		1								1					
CLO5	2	1	1			1	1	1		1								
CLO6	1	2	1		1								1					

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Green Chemistry
Course Code:	13-SEC212-2C
Pre-requisite Course:	-

Course Objectives:

1. To meet the growing demand of Specialization and Advanced Courses in applied science.
2. To make student understand about different terms use in green chemistry.
3. To learn about the basic concepts about green chemistry.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	-	-	2	25	25	-	-	50

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction to Green Chemistry Basic Principles of Green Chemistry ; Challenges --pollution control and pollution, Green methods, green products, recycling of waste, International organizations promoting green chemistry, Importance of PTC, Ionic Liquids, Ultrasound assisted reactions.	15	50
2	Designing Green Synthesis Choice of starting materials, choice of reagents, choice of catalysts, Bio catalysts, polymer supported catalysts, choice of solvents, Synthesis involving basic principles of green chemistry, Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylation, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Knoevenagel Reaction, Reformatsky reaction.	15	50

Reference Books:

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).

List of Open-Source Software/learning website:

1. <http://onlinelibrary.wiley.com>
2. https://en.wikipedia.org/wiki/Main_Page

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn and understand basic principles of green chemistry	1-Remembering 2-Understanding
CLO2	Learn and understand pollution control and waste management.	1-Remembering 2-Understanding
CLO3	Understand the important of green products and learn choice appropriate assemblies for synthesis.	1-Remembering 2-Understanding
CLO4	Learn different types of green reactions.	2-Understanding 3-Applying

Mapping of CLOs with POs

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2
CLO1	2																1	
CLO2		1			2							2						1
CLO3								1										
CLO4			1								1						2	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Vedic Mathematics
Course Code:	13-IKS102-2C
Pre-requisite Course:	

Course Objectives:

1. To understand the basic concept of Subtraction by Mental Calculation.
2. To understand the concept of Multiplication by Mental Calculation.
3. To be able to understand the Mental Calculation and Questions of Reasoning.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
-	-	4	2	--	--	25	25	50

Course Contents:

Unit	Content	Total Hours	Weightage (%)
1	Complement, Subtraction and Multiplication by specific numbers. • Complement of number • Starting Complements from the Middle of the Sum. • Leaving Complements in the middle of the Sum. • Some special and general case of subtraction. • Multiplication by 11 & 12 & 9 Key Words: Subtraction, Complement, Multiplication.	30	50
2	Multiplication and Working Base Multiplication • Base Multiplication. • Multiplication of Numbers more than the Base. • Multiplication of One more and one less than the base number. • Working Base Multiplication. • Multiplication of 2, 3, 4 Digit number. • Key Words: Multiplication, Base, Working base.	30	50

Reference Books:

- 1) Vedic Mathematics for All Ages by VandanaSinghal: MotilalBanarsidass Publisher private Limited-Delhi,2008.
- 2) Vedic Mathematics by Bharti KrishnaTirthjiMaharaj :MotilalBanarsidass Publisher private limited-Delhi, 1965.

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=eyLsbv8E4Kg&list=PLVLoWQFkZbhUFSIAjbWPVv_mlAAX8BBD1
2. <https://www.youtube.com/watch?v=X98-TJRMZRk&pp=ygUzc3VidHJhY3Rpb24gYW5kIG11bHRpcGxpY2F0aW9uIGJ5IHZlZGljIG1hdGhlbWF0aWNz>