

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science and Humanities



**Structure, Teaching Scheme and Syllabus of
B.Sc. (Honours and Honours with Research) Chemistry
Semester- VIII**

as per NEP 2020

Program Code:SC103

With effect from: 2023-24

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Advance organic chemistry
Course Code:	18-CHM406-4C
Pre-requisite Course:	Basic Chemistry up to T.Y.B.Sc.

Course Objectives:

- Students will learn and understand the basic reaction intermediates involving in organic name reactions.
- Students will study roles of oxidizing and reducing agents in organic synthesis.
- Students will gain knowledge about photochemistry.

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	Reaction intermediates Introduction, General structure, stability, methods of preparation, and reactions of carbocation, carbanion, free radical, carbene, and nirene and their applications.	15	34%
2	Reagents in Organic Synthesis [Oxidation] : CrO ₃ , MnO ₂ , KMnO ₄ , SeO ₂ , Pb(OAc) ₄ , OsO ₄ , HIO ₄ , DMSO, H ₂ O ₂ , CH ₃ COOAg (Dry & wet), RCOOOH, Ozone, HgO, NBS, K ₃ Fe(CN) ₆ , DDQ, Al(O-t-Bu) ₃ . Reagents in Organic Synthesis [Reduction]: Al(O-iPr) ₃ , Zn/HCl, N ₂ H ₄ /OH, NaBH ₄ , LiAlH ₄ , Complex Hydrides, Na/NH ₃ , Cat.H ₂ , TBTH.	15	33%
3	Photochemistry Photochemical reactions, Principle of energy transfer, electronic excitation (Jablonski diagram), Photosensitization, Photochemistry of carbonyl compounds, Norrish type-I and II, reaction of cyclic ketones, Peterno-Buchi reaction, Di-π methanerearrangement, Dienone photochemistry, Cis-trans isomerisation, Photochemistry of conjugated dienes, photo rearrangement. Barton reaction. Fluorescence chemistry and its application.	15	33%

Text Books:

1. Textbook of organic chemistry, Dr. R.L. Madan, S. Chand & company pvt. Ltd

Reference Books:

1. Organic Reaction Mechanisms, 4/Ed. V.K. Ahluwalia & Rakesh K. Parashar.
2. Advanced organic chemistry part-A F.A.Carey and R.G.Sundbreg.
3. Organic chemistry by J. Clayden, Oxford University Press.
4. Organic chemistry by R.T. Morrison and R.N. Boyd, Prentice-Hall.

List of Open-Source Software/learning website:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==>
2. <https://onlinecourses.nptel.ac.in/>

List of Experiments:

Sr.No	Practical Exercise
	Separation and identification of unknown components of ternary semi-solid/liquid organic mixture (Any 6 solid+solid+liquid/ solid+liquid+liquid/ liquid+liquid+liquidmixture having water soluble or insoluble component)

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn about different reaction intermediates in organic name reactions.	2 Understanding
CLO2	Understand and learn the general structures, stability, methods of preparation, and reactions of these intermediates.	2 Understand 3 Applying
CLO3	Understand and analyze the roles of oxidizing agents in organic synthesis.	2 Understanding 4 Analyze
CLO4	Understand and analyze the roles of reducing agents in organic synthesis.	3Applying 2 understanding
CLO5	Gain knowledge about photochemistry.	3 Applying

Mapping of CLO with PO and PSO:

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

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Advance Spectroscopy
Course Code:	18-CHM407-4C
Pre-requisite Course:	-

Course Objectives:

- The objective of the course is to gain a knowledge regarding Organic and Inorganic Advance Spectroscopy.
- To impart knowledge and training in chemistry at advanced level, make aware with recent analytical technique
- To introduce the student to principles and theory of advance spectroscopy.

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:

Sr. No	Topic	Total Hours	Weightage
1	Atomic Spectroscopy Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners), inductively coupled plasma Emission Spectroscopy (ICPAES).Application of AAS.	15	33%
2	Carbon -13 NMR Spectroscopy Introduction, Recording NMR Spectra, Multiplicity-noise decoupling, off resonance decoupling, Coupling in ¹³ C NMR, Chemical Shift, Chemical Shift Equivalence, Application of ¹³ C NMR.	15	34%
3	Advance Spectroscopy & Structural elucidation Introduction to ¹⁵ N, ¹⁹ F, ³¹ P NMR spectroscopy, Proton NMR chemical shift for common functional groups, 2D NMR, Comparison of 1D & 2D NMR, DBE, Numerical problem on UV, IR and NMR.	15	33%

Text Books:

1. Instrumental method of Chemical Analysis by B.K.Sharma

Reference Books:

1. Spectroscopy of organic compounds by P.S.Kalsi
2. Introduction of spectroscopy by Donald L.Pavia, Gary M. Lampman, George S. Kriz
3. Analytical Chemistry” by Gary D. Christian, 7th Edition, Published 2013 by John Wiley and Sons Inc. New jersey.
4. Quantitative Chemical Analysis” by Daniel C. Harris, 8th Edition, Published 2010 by W.H. Freeman and Company, New York.
5. Elementary Organic Spectroscopy by Y. R. Sharma.

List of Open Source Software/learning website:

1. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==>
2. <https://archive.nptel.ac.in/courses/104/108/104108078/>

List of Experiments:

Sr.No	Practical Exercise
•	Preparation of Organic compound and spectral interpretation (IR, NMR and MASS)
1.	Preparation of p-Nitro acetanilide from Acetanilide
2.	Preparation of Acetanilide from Aniline
3.	Preparation of Salol.
4.	Preparation of dihydropyrimidones by using biginelli reaction.
5.	Preparation of Di-benzyl acetone from Benzaldehyde
6.	Spectral interpretation of unknown compound. (IR, NMR and MASS)

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

CLO	Description	Bloom's Taxonomy Level
CLO1	To learn and understand basic principle and difference between Emission Spectroscopy (ES) and Atomic adsorption Spectroscopy	1.Remembering 2.Understanding
CLO2	To understand inductively coupled plasma Emission Spectroscopy and application of AAS	2.Understanding 3.Applying
CLO3	To understand about principles, phenomenon and application regarding of ^{13}C NMR,	2.Understanding 3.Applying
CLO4	To understand about Heteronuclear NMR and analyze Comparison between 1D & 2D NMR.	2.Understanding 4. Analyzing
CLO5	Numerical problem solving on UV, IR and NMR.	3.Applying 4. Analyzing

Mapping of CLO with PO and PSO:

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

3:High, 2:Medium, 1:Low

**Faculty of Science and Humanities**

B.Sc. (Chemistry) (Semester - VII)

(Honours / Honours with Research)

In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Electroanalytical Methods
Course Code:	18-CHM408-4C
Pre-requisite Course:	-

Course Objectives:

- Describe the working principles and instrumentation of potentiometry, conductometry, coulometry, electrogravimetry, and voltametric methods.
- Evaluate the accuracy, sensitivity, selectivity, and limitations of various electroanalytical methods in comparison with other instrumental techniques
- Demonstrate practical skills and safety awareness in operating electroanalytical instruments and electrodes for real-sample analysis.

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:

Sr. No	Topic	Total Hours	Weightage
1	Instrumental analysis pH metry(Principle of instrumentation and mechanism of pH by glass electrode), Potentiometry, Conductometry , types of electrodes and explanation of the nature of titration curves	15	33%
2	Electrodeposition and Coulometry, Electrolysis , Current-Voltage relation, Types of Electrogravimetric analysis (constant current, constant potential) Mercury cathode. Coulometric analysis, Various types of coulometers, Applications of coulometric titration Types of Coulometric Methods.	15	34%
3	Electrophoresis Principles of electrophoresis, theory and applications of Poly-acrylamide gel electrophoresis, micelles capillary zone electrophoresis, electro kinetic electrophoresis, Iso-electric focusing. Applications of Electrophoresis.	15	33%

Text Books:

1. Instrumental method of Chemical Analysis by B.K.Sharma

Reference Books:

1. Electroanalytical Chemistry. John Wiley & Sons, New York by Basil H. Vassos, Galen W. Ewing
2. Principles of Instrumental Analysis" 6th ed. Thomson Brooks/Cole Publishing:Belmont, CA 2007.by Skoog, D.A.; Holler, F.J.; Crouch, S.R

List of Open-Source Software/learning website:

1. <https://nptel.ac.in/courses/104105084>

List of Experiments:

Sr.No	Practical Exercise
•	Ph (mixture)
1.	To determine normality and amount of each acid in the given mixture of HCl+CH ₃ COOH by pH metrically.
2.	To determine the strength of strong and weak base in a given mixture using a pH meter.
•	Potential
3.	To determine concentration of the given Iodide solution by Potentiometric titration against 0.1 N KMnO ₄ .
4.	To determine the strength of strong and weak acid in a given mixture by potentiometric titration using 0.1 N NaOH.
•	Colouri (Cu)
5.	To study Beer's law and determine the concentration of unknown solution of Cu ⁺² by ammonia complex method.
6.	To study Beer's law and determine the concentration of unknown solution of Ni ⁺² by ammonia complex method.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	To learn & recall the basic principles, terminology, and instrumentation involved in pH-metry, potentiometry, and conductometry.	1.Remembering 2.Understanding
CLO2	To apply appropriate experimental procedures to perform pH measurements, potentiometric titrations, and conductometric titrations accurately.	3.Applying
CLO3	To understand the basic concepts, laws (Faraday's laws), terminology, and instrumentation related to electro deposition and coulometric analysis.	1.Remembering 2.Understanding
CLO4	To understand the principles of electro deposition and coulometry, including constant-current and constant-potential methods.	2.Understanding

CLO5	To learn and understand the basic principles, terminology, and types of electrophoresis (paper, gel, capillary electrophoresis).	1.Remembering 2.Understanding
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Mapping of CLO with PO and PSO:

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

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Title:	Industrial chemistry-II
Course Code:	18-CHE402-4C
Pre-requisite Course:	Basic Chemistry up to T.Y.B.Sc.

Course Objectives:

- Learn about soaps, detergents, preservatives, oils, fats and agrochemicals.
- The primary goal of this course is to make students aware of how chemical process in the industry can be designed, developed and employed in a sustainable manner.

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	Soap, detergents and preservatives Detergents, surfactants, alkyl benzenes, fatty acids, fatty alcohols, soaps essential oils, constituents, animal fixatives, fruit concentrates, vanilla, chocolate, monosodium glutamate, food additives and preservatives.	15	33%
2	Oils, fats and agrochemicals Vegetable oils, cotton seed oil, hydrogenation, agrochemicals, insecticides, fungicides, weedicides, rodenticides, plant nutrients and plant hormones.	15	34%
3	Pulp and paper Pulp, pulping process, Sugar-ethanol industries base carboxyl manufacture of paper and rayon.	15	33%

Text Books:

1. A Textbook of Industrial Chemistry · by Dr. Farooqui Maqdoom

Reference Books:

1. Chemical Process Principles: (Part I), Haugen, Watson and Regatz (Asia Pub. House).
2. Chemistry of Engineering Materials by C. V. Agrawal (Tara Publication).
3. Industrial chemistry by B. K. Sharma (Goel publishing House)

List of Open-Source Software/learning website:

1. https://prsuniv.ac.in/Syllabus/BSC_Industrial_Chemistry.pdf

List of Experiments:

Sr.No	Practical Exercise (Any 3)
1.	Synthesis of product: Soap
2.	Synthesis of product: Vicks
3.	Synthesis of product: shampoo
4.	Synthesis of product: Iodex balm

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Learn the preparation of soaps, detergents and preservatives.	Learning
CLO2	Learn and understand the basic process for hydrogenation of vegetable oil.	Understanding Learning
CLO3	Understand basic applications of various agrochemicals, papers and pulp	Understanding evaluating
CLO4	Students will demonstrate an advanced level of knowledge in industrial chemistry.	Applying

Mapping of CLO with PO and PSO

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

3:High, 2:Medium, 1:Low

Branch Name:	B.Sc. Chemistry
Program Code:	SC103
Course Name:	Radio Chemistry
Course Code:	18-CHE402-40
Pre-requisite Course:	-

Course Objectives:

- Student can understand the basics of radioactivity, radioactive decay laws and applications of radioactive isotopes.
- Student can analyze the behavior of radiation and isotopes in chemical systems.
- They can gain the knowledge of nuclear reactions, their types and applications.
- To develop conceptual knowledge of nuclear chemistry principles.

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:

Sr. No	Topic	Total Hours	Weightage
1	Natural Radio activity Introduction, nature of rations from radioactive substances, Decay schemes, Group displacement law, Mechanism of radioactive decay, Geiger-Nuttals rule, Radioactive series of Uranium.	15	33%
2	Chemistry of Radiation Introduction, Types, Isotopic exchange, Distribution of micro concentration of radioactive isotops between two phases, Laws of coprecipitation, The state of radio isotops in ultra small concentration, Radioactive Isotops in solution(factors & methods)	15	34%
3	Nuclear Reactions Classification of nuclear reactions, Q Value of a Nuclear reaction, Threshold energy for a nuclear reaction, Reaction Cross section, Type of Reactions: Scattering reaction, Direct nuclear reaction, Photo nuclear reaction, Thermonuclear reaction.	15	33%

Text Books:

1. *A Text Book of Nuclear Chemistry*. V Shekar; Dominant Publisher and Distributors, New Delhi, 1102

Reference Books:

1. *Introduction To Radiochemistry*, A.V.R. Reddy & D.D. Sood, Indian Association Of Nuclear Chemists and Allied Scientists

List of Open-Source Software/learning website:

1. www.radiochemistry.org

List of Experiments:

Sr. No	Practical Exercise (any 3)
•	Characterization of drug substances by powder XRD.

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the nature of radioactive radiations, decay mechanisms, displacement law, Geiger–Nuttall rule, and uranium decay series.	1.Remembering 2.Understanding
CLO2	To understand the radioactive isotopes of their phase	2.Understanding
CLO3	To learning radioactive isotopes in solution for their factor and methods	2.Understanding
CLO4	To apply the Q value of nuclear reactions	2.Understanding 4.Analyzing
CLO5	To understand the types of Reactions of radiochemistry	2.Understanding

Mapping of CLO with PO and PSO

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

3: High, 2: Medium, 1: Low