

ST. XAVIER'S COLLEGE (AUTONOMOUS)

AHMEDABAD

**Chemistry Syllabus
for
Four-Year Undergraduate Program
as per
National Education Policy (NEP-2020)
(Semester II)**



(EFFECTIVE FROM JUNE 2023)

ST. XAVIER'S COLLEGE (Autonomous), AHMEDABAD
Chemistry
Theory syllabus

PROGRAMME SPECIFIC OUTCOMES

A student completing this program will be able to

PSO1: Knowledge: Apply the principles of analytical, organic, inorganic and physical chemistry to solve basic chemical problems locally and globally

PSO2: Laboratory skills: Employ classical and modern laboratory techniques in the performance and documentation of experiments, suitable for a chemical industry or a chemistry graduate program.

PSO3: Environmental concern: Practice environmentally benign chemistry

PSO4: Employability/future prospects: Develop problem-solving skills and aptitude that are highly valuable to employers and entrepreneurship skills for self-employment

PSO5: Scientific communication: Have effective written and oral scientific communication skills, especially the ability to transmit complex technical information in a clear and concise manner

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – II of the following department under Faculty of Science based on Under Graduate Curriculum Framework - 2023 to be implemented from the Academic Year 2023-24.

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

Course	Title	Content	Hours/week	Credit
Minor-1 (Theory) CH-2101	Basics of Chemistry-2	Unit-1 [15L] (A) Organic Chemistry: Stereochemistry of organic compounds (B) Inorganic Chemistry: Co-ordination compounds Unit-2 [15L] (A) Physical Chemistry : Kinetics and Thermodynamics (B) Analytical Chemistry : Errors in Quantitative Analysis	2 hrs	2
Minor-1 (Lab)	Basics of Chemistry-2(Practical)	Practical based as per Theory syllabus.	4 hrs	2

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FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

BSc. (Hons.) Chemistry
Category – IV

Minor Course – 1: Basics of Chemistry-2 (Theory)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Fundamentals of Chemistry-2 (CH-2101)	2	0	0	10 + 2 from a recognized board in any stream	Basic Knowledge of Chemistry, Observation and analytical skills

LEARNING OBJECTIVES (LO)

LO1: To Draw the possible stereoisomers of various molecules. Distinguish between enantiomers, diastereomers, and meso compounds and explain their physical properties, especially in chiral environments such as the human body. Use the Cahn-In gold-Prelog convention to correctly assign R and S nomenclature. To knowledge of physical and chemical composition of the transition elements - complexes. - To explains the science of Coordination Compounds and the types of the ligands, - To understand the coordination numbers and geometric shapes of the complexes. - To Recognize the ways of naming complexes..

LO 2: To improve the efficiency of a process for the transformation between energy and work. To study energy conversion in different forms. To study the entropy of a system. Expresses the

qualitative analysis methods. To evaluate the analytical data in terms of statistics. To estimate kinds of errors in chemical analysis.

COURSE OUTCOME(CO)

On Completion of this course, the student will be able to-

CO1: Use the fundamentals of stereo-chemical and conformational analysis to identify the configuration and conformation of the given organic compounds and to recognize and apply the principles of Werner's theory and VB theory to understand bonding in co-ordination complexes formed by transition metals

CO2: Calculate the work function and free energy of chemical systems to determine the spontaneity of the reaction and also modify the kinetic rate equation and to identify the errors and to reduce it.

Unit-1

(A) Organic Chemistry [15L]

(1) Optical isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic centre,

optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D and L, R and S systems of nomenclature.

(2) Geometric isomerism — determination of configuration of geometric isomers. E and Z system of nomenclature.

(3) Conformational isomerism — Difference between configuration and conformation. conformational analysis of ethane and n-butane; Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

(B) Inorganic Chemistry

Co-ordination compounds

(1) Werner's theory, nomenclature, chelates

(2) Valence Bond theory of co-ordination compounds, stereochemistry of numbers 4, 5 and 6.

(3) Various types of isomerism in co-ordination complexes.

Unit-2 [15L]

(A) Physical Chemistry

Kinetics and Thermodynamics

Theories of reaction rates: Collision theory of bimolecular gaseous reactions and Activated Complex

theory of bimolecular reactions; Effects of temperature on reaction rates; Derivation of Arrhenius equation. Kinetics of enzyme catalyzed reaction .

Work and free energy functions; Helmholtz function and variation of free energy change with temperature and pressure; Gibbs Helmholtz equation, derivation. Types of energetic reactions Nernst theorem and consequences Numericals based on theory.

(B) Analytical Chemistry

Unit 2(B) Errors in Quantitative Analysis

Introduction, Errors, Types of Errors, Accuracy and Precision, Precision measures, Rejection of measurements, Minimization of Errors, significant figures.

Suggestive Reading: CH 2501 Basics of Chemistry-2 - (Theory)

(1) "Concise Inorganic Chemistry" by J. D. Lee, 5/E, Oxford University Press, Indian Edition.

- (2) "Basic Inorganic Chemistry" by F. A. Cotton and G. Wilkinson, Wiley publication.
- (3) "Inorganic Chemistry" by Shriver & Atkins, 4/E, Oxford University Press, Indian Edition.
- (4) "Text book of Organic Chemistry" by P. L. Soni and H. M. Chawla, 26/E, 1995, Sultan Chand & Sons Publication, New Delhi.
- (5) "Text book of Organic Chemistry" by P. S. Kalsi, 1999, MacMillan of India Pvt. Ltd.
- (6) "Organic Chemistry" by Bhupinder Mehta, Manju Mehta, Prentice Hall of India Pvt.Ltd, New Delhi.
- (7) "Elements of Physical Chemistry" by Peter Atkins & Julio De Paula, 5/E, Oxford University Press, Indian Edition.
- (8) "Principle of Physical Chemistry" by Puri, Sharma & Pathania, 41/E, Vishal Publishers.
- (9) Essential of physical chemistry, B.S.Bahl, G.D.Tuli and Arun Bahl, S.Chand-New Delhi, Reprint, 2006.
- (10) Instrumental Methods of chemical analysis by B.K.Sharma, Goel Publishing House.
- (11) Analytical Chemistry, by Gary D. Christian, John Wiley & Sons, INC, New York, 1994. (Fifth edition)

Suggested Online Links/Readings:

<https://swayam.gov.in>

https://www.iscnagpur.ac.in/knowledge_learning_files/5.7_General_Open_Access_e-Resources.pdf

<https://ndl.iitkgp.ac.in>

<https://nptel.ac.in/course.html>

Pedagogy:

1. Lecture method with teaching aids.
2. Audio-Visual Teaching mode with Projector Method.
3. Dialogue and context-based class.
4. Assignments, Learning seminar, Class Test etc.

MODE OF EVALUATION:

Evaluation will be divided in two parts.

ASSESSMENT	MARKS
INTERNAL	
Attendance	05
Assignment	05
Continuous Internal Assessment I and II	15
TOTAL	25 marks
EXTERNAL	
End Semester Exam	25 marks

Students will prepare and present (in pairs) a Submission related to the topic of Assignment on allotted areas. These Submission will be presented in form of Hand written notes etc. Points for evaluation: Presentation (20%) + Content (20%) + explanation (20%) + Creativity (20%) + Overall impression (20%).

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FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

BSc. (Hons.) Chemistry
Category – IV

Minor Course – 1: Basics of Chemistry-2(Practicals)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Basics of Chemistry – 2 (Practicals) (CH-2101)	0	0	2	10 + 2 from a recognized board in any stream	Basic Knowledge of Chemistry, Observation and Analytic skills

LEARNING OBJECTIVE (LO)

LO1: To demonstrate proficiency in the experimental techniques and methods of appropriate Organic qualitative Analysis and Quantitative analysis as different types of titrations.

LO2: To get familiarized with the basic skills and techniques related to Quantitative and qualitative Analysis.

LO 3: To gain knowledge of different reactions and types of reactions.

Course Outcomes:

CO1: Use the principles of titrimetric analysis to determine the concentration of unknown metal solution and redox reagents

CO2: Apply the principles of organic separation and functional group reactivity to identify qualitatively

the given organic compound

(A) Volumetric Analysis:-

(a) Redox Titrations:-

(1) KMnO_4 $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$

(2) $\text{K}_2\text{Cr}_2\text{O}_7$ $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$

(b) Complex metric Titration by EDTA:-

(1) Estimation of Ca^{+2} / Mg^{+2} EDTA

(B) Organic Spotting :- (06 Solids and 04 Liquids).

List organic compounds having different mono functional groups: Solids : Acids : (i) Benzoic acid (ii) Oxalic acid (iii) Succinic acid (iv) Phenols : (i) β -Naphthol (ii) α -Naphthol (iii) Resorcinol (iv) Phenol Neutral : (i) Urea (ii) Thiourea (iii) Benzamide (iv) Naphthalene Liquids : (i) Aniline (ii) Nitrobenzene (iii) Benzaldehyde (iv) Ethanol (v) Ethylacetate (vi) Chloroform (vii) Chlorobenzene (viii) Acetone

Suggested Readings: CH 2101 Chemistry (Practicals)

- (1) Vogel's Textbook of Quantitative Chemical analysis|| Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, 5/E, ELBS (English Language Book Society) Longman.
- (2) Analytical Chemistry|| by Dhruba Charan Dash, PHI Learning Private Ltd, 2011, New Delhi,
- (3) Analytical Chemistry|| by Gary D. Christian, 4/E, John Wiley & Sons.
- (4) Comprehensive Practical Organic Chemistry – Qualitative Analysis|| by V. K. Ahluwalia, Sunita Dhingra, First Indian Reprint 2010, University Press (India) Private Limited, Hyderabad,
- (5) Organic Analytical Chemistry theory and Practice|| by Mohan Jag, Narosa

MODE OF EVALUATION:

Sr. No.	Exam Pattern	Internal Exam	External Exam
1	Practical/Performance	20	25
2	Attendance	5	00
	Total	25 marks	25 marks