



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

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ABOUT THE DEPARTMENT

Started as a supportive subject to P.U.C in 1967 and as allied to UG Mathematics course in 1972, the Department has been elevated to offer **B.Sc., (Chemistry)** major Programme during 1979 with Mathematics / Botany and Physics as Ancillary subjects. The Department has been producing exemplary results right from its inception. The Department is constantly concentrating on the overall development of students. So far 42 batches of students have successfully finished their graduation. Many of them have pursued their higher education in various prestigious institutions like MIT, IISc, IIT, Central University and the others have been well placed as production executives and marketing executives in Chemical and Pharma industries.

VISION

To train the students of Chemistry as scientifically literate professionals with a sense of social responsibility.

MISSION

- To encourage the advancement of Chemistry in all of its branches through education, research and service opportunities.
- To provide students with community need based research and outreach opportunities.
- To strive for an ideal balance between creation and knowledge dissemination in the chemical sciences.
- To train our students to succeed in competitive examinations



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GRADUATE ATTRIBUTES

1. **(KB) A knowledge base for Chemistry:** Demonstrated competence in university level mathematics, natural sciences, knowledge appropriate to the program.
2. **(PA) Problem analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex problems in order to reach substantiated conclusions
3. **(Inv.) Investigation:** An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data and synthesis of information in order to reach valid conclusions.
4. **(Des.) Design:** An ability to design solutions for complex, open-ended problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **(Tools) Use of tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern tools to a range of activities, from simple to complex, with an understanding of the associated limitations.
6. **(Team) Individual and teamwork:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7. **(Comm.) Communication skills:** An ability to communicate complex scientific concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **(Prof.) Professionalism:** An understanding of the roles and responsibilities of the graduates in society, especially the primary role of protection of the public and the public interest.
9. **(Impacts) Impact of Chemistry on society and the environment:** An ability to analyze social and environmental aspects of science activities. Such ability includes an understanding of the interactions that Chemistry with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **(Ethics) Ethics and equity:** An ability to apply professional ethics, accountability, and equity.
11. **(Econ.) Economics and project management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of science and to understand their limitations.
12. **(LL) Life-long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge



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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The B.Sc., Chemistry Graduates of the Sourashtra College will:

PEO 1	be well prepared for successful careers in the profession at an industry and/or in government in one or more of discipline of chemistry.
PEO 2	be academically prepared to become licensed professional chemists in due course and will contribute effectively in serving the society.
PEO 3	be engaged in professional activities to enhance their own achievement and simultaneously contribute in service of mankind.
PEO 4	be successful in higher education in Chemistry.
PEO 5	have leadership quality to work in all kind of circumstances, diverse environment such as interdisciplinary and multidisciplinary learning systems.
PEO 6	have proper laboratory and safety techniques with effective scientific communication skills.

UNDERGRADUATE (UG) PROGRAMME OUTCOMES (POs)

Undergraduate (B.A., B.Sc., B.Com., B.C.A., B.B.A., etc.) is a 3 – year degree Programme with 6 semesters consisting the following Programme Outcomes (POs) under various criteria including critical thinking, problem solving, effective communication, societal/ citizenship/ ethical credibility, sustainable growth and employable abilities.

PO 1	Critical Thinking: Intellectual exploration of knowledge towards actions in clear and rational manner by understanding the logical connections between ideas and decisions.
PO 2	Problem Solving: Understanding the task/ problem followed by planning and narrow execution strategy that effectively provides the solution.
PO 3	Effective Communication: Knowledge dissemination by oral and verbal mechanisms to the various components of our society.
PO 4	Societal/ Citizenship/ Ethical Credibility: Realization of various value systems/ moral dimensions and demonstrate the empathetic social concern as well as equity in all the decisions, executions and actions.
PO 5	Environmental Concern and Sustainable Growth: Understanding the emerging environmental challenges and provide the possible contribution in sustainable development that integrates environment, economy and employment.
PO 6	Skill Development and Employable Abilities: Adequate training in relevant skill sector and creating employable abilities among the under graduates.



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PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of **B.Sc. Chemistry Programme**, the students are expected /will be able to

PSO 1	get a firm foundation in the fundamentals and applications of chemical and scientific theories including environmental and biological aspects in chemistry.
PSO 2	make use of experiments by demonstration with the help of analytical instruments and analyze the outcomes.
PSO 3	develop skills in problem solving, critical thinking and analytical reasoning as applied to chemistry related problems.
PSO 4	find the solution for the ethical, historic, philosophical, economic and environmental dimensions of problems and issues facing chemists.
PSO 5	pursue post graduate program in higher educational institutions and also to get suitable employment opportunities in industries and academic institutions.
PSO 6	exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

DISTRIBUTION OF CREDITS (UG PROGRAMME)

PART	SEM	COURSES	NO. OF COURSES	HOURS	CREDITS	TOTAL CREDITS
I	I-IV	LANGUAGE	4	6	3	12
II	I-IV	ENGLISH	4	6	3	12
III	I-VI	CORE	15	4-5	2-5	60
III	I-IV	ALLIED	4	6	5-6	20
III	V-VI	ELECTIVE	3	5	5	15
IV	I-IV	SKILL BASED SUBJECT	6	2	2	12
IV	I	VALUE EDUCATION	1	2	2	2
IV	I	ENVIRONMENTAL STUDIES	1	2	2	2
IV	III, IV	NON MAJOR ELECTIVE	2	2	2	4
V	IV	EXTENSION ACTIVITY	1	0	1	1
	V	SELF – STUDY (SOFT SKILLS)	1	0	0	0
	VI	SELF –STUDY (G.K. (ONLINE))	1	0	0	0
TOTAL						140
Any online courses in SWAYAM PORTAL						



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B.SC. CHEMISTRY – COURSE STRUCTURE SEMESTER – I

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT11	Part – I: Tamil – பொதுத் தமிழ் – I	6	3	25	75	100	3
	24UACH11	Hindi – General Hindi – I						
	24UACS11	Sanskrit – Poetry, Grammar and History of Sanskrit Literature						
2.	24UACE11	Part – II: English – General English – I	6	3	25	75	100	3
3.	24UCYC11	Part – III: Core – 1 T: General Chemistry – I	5	3	25	75	100	4
4.	24UCYCP1	Part – III: Core – 2 P: Quantitative Inorganic Estimation *	3	–	–	–	–	–
5.	24UMSA11/ 24UBYA11	Part – III: Allied 1 – 1 T: Mathematics / Botany*	6 / 4	3	25	75	100	5 / 4
6.	24UBYAP1	Part – III: Allied 1 – 1 P: Botany Practical*	2	–	–	–	–	–
7.	24UCYS11	Part – IV: SBS – 1 T: Milk Science	2	3	25	75	100	2
8.	24UACVE1	Part – IV: Value Education	2	3	25	75	100	2
TOTAL			30				600	19

*Practical Examination conducted at the end of the even semester

SEMESTER – II

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT21	Part – I: Tamil – பொதுத் தமிழ் – II	6	3	25	75	100	3
	24UACH21	Hindi – General Hindi – II						
	24UACS21	Sanskrit – Prose, Grammar and History of Sanskrit Literature						
2.	24UACE21	Part – II: English – General English – II	6	3	25	75	100	3
3.	24UCYC21	Part – III: Core – 3 T: General Chemistry–II	5	3	25	75	100	4
4.	24UCYCP1	Part – III: Core – 2 P: Quantitative Inorganic Estimation	3	3	40	60	100	2
5.	24UMSA21/ 24UBYA21	Part – III: Allied 1 – 2 T: Mathematics / Botany	6 / 4	3	25	75	100	5 / 4
6.	24UBYAP1	Part – III: Allied 1 – 1 P: Botany Practical	2	3	40	60	100	2
7.	24UCYS21	Part – IV: SBS – 2 T: Chemistry Behind Laboratory Practices	2	3	25	75	100	2
8.	24UACES1	Part – IV: Environmental Studies	2	3	25	75	100	2
TOTAL			30				800	23



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SEMESTER – III

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – I: Tamil – காப்பியமும் நாடகமும்	6	3	25	75	100	3
		Hindi – Hindi – III						
		Sanskrit – Sanskrit – III						
2.		Part – II: English – English for Enrichment – III	6	3	25	75	100	3
3.		Part – III: Core – 4 T: Inorganic Chemistry–I	4	3	25	75	100	4
4.		Part – III: Core – 5 T: Physical Chemistry– I	4	3	25	75	100	4
5.		Part – III: Core – 6 P: Inorganic Qualitative Analysis*	2	–	–	–	–	–
6.		Part – III: Allied 2 –3 T: Ancillary Physics	4	3	25	75	100	4
7.		Part – III: Allied 2 –2 P: Physics Practical *	2	–	–	–	–	–
8.		Part – IV: NME – 1: Chemistry for Human Welfare – I	2	3	25	75	100	2
		TOTAL	30				600	20

*Practical Examination conducted at the end of the even semester

SEMESTER – IV

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – I: Tamil – சங்க இலக்கியமும் அற இலக்கியமும்	6	3	25	75	100	3
		Hindi – Hindi – IV						
		Sanskrit – Sanskrit – IV						
2.		Part – II: English – English for Enrichment – IV	6	3	25	75	100	3
3.		Part – III: Core – 7 T: Inorganic Chemistry–II	4	3	25	75	100	4
4.		Part – III: Core – 8 T: Organic Chemistry– I	4	3	25	75	100	4
5.		Part – III: Core – 6 P: Inorganic Qualitative Analysis	2	3	40	60	100	2
6.		Part – III: Allied 2 – 4 T: Ancillary Physics	4	3	25	75	100	4
7.		Part – III: Allied 2 –2 P: Physics Practical	2	3	40	60	100	2
8.		Part – IV: NME – 2: Chemistry for Human Welfare– II	2	3	25	75	100	2
9.		Part – V: Extension Activities	–	–	–	–	100	1
		TOTAL	30				900	25



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SEMESTER – V

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – III: Core – 9 T: Organic Chemistry–II	6	3	25	75	100	5
2.		Part – III: Core – 10 T: Physical Chemistry–II	5	3	25	75	100	4
3.		Part – III: Core – 11 P: Physical Chemistry Experiments	6	6	40	60	100	5
4.		Part – III: Core – 12 P: Organic Estimation and Organic Preparation	4	3	40	60	100	3
5.		Part – III: Elective – 1 T:	5	3	25	75	100	5
		Coordination Chemistry, Bio–Inorganic Chemistry and Organometallic compounds						
		Chemistry of Materials						
		Forensic Chemistry						
6.		Part – IV: SBS – 3 T: Applied Organic Spectroscopy	2	3	25	75	100	2
7.		Part – IV: SBS – 4 T: Applied Chemistry	2	3	25	75	100	2
8.		Soft Skills (Self – Study)	–	–	–	–	100	–
		TOTAL	30				800	26

*One elective course to be chosen from THREE courses



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SEMESTER – VI

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – III: Core – 13 T: Organic Chemistry–III	6	3	25	75	100	5
2.		Part – III: Core – 14 P: Gravimetric Estimation and Inorganic Complex Preparation	6	6	40	60	100	5
3.		Part – III: Core – 15 P: Organic Analysis	4	3	40	60	100	3
4.		Part – III: Elective – 2 T: Advanced Physical Chemistry	5	3	25	75	100	5
		Battery and Fuel Cells						
		Food Chemistry						
5.		Part – III: Elective – 3 T: Analytical Chemistry and Computer Applications in Chemistry	5	3	25	75	100	5
		Medicinal Chemistry						
		Polymer Chemistry						
6.		Part – IV: SBS – 5 T: Pharmaceutical and Clinical Chemistry	2	3	25	75	100	2
7.		Part – IV: SBS – 6 T: Green Chemistry and Nanochemistry	2	3	25	75	100	2
8.		General Knowledge (Self–Study)	–	–	–	–	100	–
		TOTAL	30				900	27

*One elective course to be chosen from THREE courses



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COURSE STRUCTURE – I SEMESTER

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT11	Part – I: Tamil – பொதுத் தமிழ் – I	6	3	25	75	100	3
	24UACH11	Hindi – General Hindi – I						
	24UACS11	Sanskrit – Poetry, Grammar and History of Sanskrit Literature						
2.	24UACE11	Part – II: English – General English – I	6	3	25	75	100	3
3.	24UCYC11	Part – III: Core – 1 T: General Chemistry – I	5	3	25	75	100	4
4.	24UCYCP1	Part – III: Core – 2 P: Quantitative Inorganic Estimation*	3	–	–	–	–	–
5.	24UMSA11/ 24UBYA11	Part – III: Allied 1 – 1 T: Mathematics / Botany*	6 / 4	3	25	75	100	5 / 4
6.	24UBYAP1	Part – III: Allied 1 – 1 P: Botany Practical*	2	–	–	–	–	–
7.	24UCYS11	Part – IV: SBS – 1 T: Milk Science	2	3	25	75	100	2
8.	24UACVE1	Part – IV: Value Education	2	3	25	75	100	2
		TOTAL	30				600	19

*Practical Examination conducted at the end of the even semester

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

NME – Non –Major Elective

T – Theory

P – Practical



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYC11	GENERAL CHEMISTRY – I	CORE – 1	5	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course imparts basic idea about atomic structure and helps to understand the theories pertaining to how atoms are linked with one another with usage of periodic table and also to acquire a thorough knowledge about the types of bonds. This course gives a thorough knowledge of basics of organic chemistry & organic reactions.

COURSE OBJECTIVES:

To make the students

- learn the origin and structure of atom.
- refresh the sequence of elements and essential properties to understand the formation of molecules.
- study the concept of various types of bonds.
- understand the basic concepts about bonding (VBT & MOT)
- study about the basic concepts of organic chemistry

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain the atom on the basis of classical mechanics and quantum mechanics.	Upto K3
CO 2	illustrate the atomic properties	Upto K3
CO 3	identify the bonding in molecules	Upto K3
CO 4	predict the geometry of molecules with the help VB theory and VSEPR theory	Upto K3
CO 5	understand the basic concepts in organic chemistry	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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GENERAL CHEMISTRY – I

UNIT – I: ATOMIC STRUCTURE (15 hrs.)

Constituents of atom – Planck's Quantum theory: Black body radiation – Photoelectric effect – Compton effect – Bohr model of the atom – postulates of Bohr's theory (no radius and energy calculation) hydrogen spectrum – Zeeman effect – de Broglie's equation – the wave nature of the electron – Heisenberg's uncertainty principle – Quantum numbers – Pauli's exclusion principle – Aufbau principle – Hund's rule – concept of effective nuclear charge – Slater's rules.

UNIT – II: PERIODIC TRENDS (15 hrs.)

Modern Periodic table and its salient features – Periodicity and magic number – Periodic properties: atomic volume, size of atoms and ions, ionization energy and electron affinity – factors influencing these (including screening effect and effective nuclear charge) and their periodic trends – electronegativity: definition, Pauling and Mulliken scales – factors affecting the magnitude of electronegativity and their periodic trends – applications.

UNIT – III: CHEMICAL BONDING – I (15 hrs.)

Cause of chemical bonding – Octet rule – Types of bonds – Ionic bond: definition – ionic compounds – factors favoring the formation of ionic compounds including Lattice energy and properties – Metallic bond: definition and conditions for the formation of metallic bond – significance – Hydrogen bond: definition and types – consequence and significance – vanderWaal's forces: definition and types – applications

UNIT – IV: CHEMICAL BONDING – II (15 hrs.)

Covalent bond : definition – covalent compounds : factors favouring the formation and properties – Valence Bond theory – Postulates – applications to H_2 and HF molecules – Molecular Orbital approaches – explanation and applications to various molecules including homonuclear (H_2, He_2, F_2, O_2) and heteronuclear (HF, CO) molecules.

Hybridization: definition and types: sp, sp^2, sp^3, sp^3d and sp^3d^2 ($BeF_2, BCl_3, CH_4, PCl_5, SF_6$) – VSEPR theory : Postulates – applications to H_2O, NH_3, ClF_3 and ClO_4^- molecules – Ionic character in covalency : Fajan's rule – Coordinate Bond : definition and conditions for formation of a coordinate bond.



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UNIT– V: BASIC CONCEPTS IN ORGANIC CHEMISTRY (15 hrs.)

- Characteristics of organic compounds – catenation – classification of organic compounds – homologous series – functional groups – nomenclature – IUPAC system – Empirical formula – molecular formula – problems.
- Tetrahedral valency of carbon – homolytic and heterolytic fissions of C–C bond – formation and stability of carbonium ions, carbanions and free radicals – electrophilic and nucleophilic reagents.
- Electronic effects: inductive effect – mesomeric effect – resonance effect – hyperconjugation effect.
- Types of organic reactions – substitution – addition – elimination – rearrangement – polymerization - examples (mechanism not required).

TEXT BOOKS:

- Principles of Physical Chemistry* by B.R. Puri, L.R. Sharma and S. Pathania – Vishal Publishing Co. 43rd Edn. (2022)
- Principles of Inorganic Chemistry* by Puri, Sharma & K.C. Kalia, Milestone Publishers, 48th Edn. (2019).
- Modern Organic Chemistry* by M. K. Jain and S. C. Sharma – Vishal Publishing Co. 4th Edn. (2014)

REFERENCE BOOKS:

- Modern Inorganic Chemistry* by R.D. Madan S. Chand and Co. Ltd. (2012).
- Essentials of Physical Chemistry* by B. S. Bahl, Arun Bahl and G. D. Tuli, S. Chand and Co. Ltd. (2016).
- Inorganic Chemistry* by R.L. Madan & G.D. Tuli, S. Chand and Co. Ltd (2018)

DIGITAL TOOLS:

- <https://www.youtube.com/watch?v=pmUhkQjHr3A>
<https://www.youtube.com/watch?v=Iaq2kerxuWU&list=PLyqSpQzTE6M93oV6C9iM4VpoiTqlz4vwi>
- https://www.youtube.com/watch?v=n81pP8V4Jg&list=PLbu_fGT0MPsu3kB3ZuX3mZYRPwqa8nXLC
- <https://www.youtube.com/watch?v=AE5QcL4VfH4&t=160s>
- https://www.youtube.com/watch?v=JjidYZYb_ck&t=938s
<https://www.youtube.com/watch?v=wj4u5hM6QhI>
- <https://www.youtube.com/watch?v=tpx7zP2M0Nw>
<https://www.youtube.com/watch?v=MhZSx0-VDi8>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	2
CO2	3	1	3	1	3	2
CO3	3	1	3	2	3	2
CO4	3	1	3	2	3	2
CO5	3	1	2	2	3	1

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. M. RAJASEKARAN



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYCP1	QUANTITATIVE INORGANIC ESTIMATION	CORE – 2 PRACTICAL	–	3	–

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	–	–	–

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course gives the practical knowledge in volumetric analysis.

COURSE OBJECTIVE:

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard solution.

COURSE OUTCOME (CO):

After the completion of the Course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO	illustrate the estimation of substance by various types of titration method	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLYING

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard Solution



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QUANTITATIVE INORGANIC ESTIMATION

LIST OF EXPERIEMENTS

I. ACIDMETRY AND ALKALIMETRY

1. Estimation of Na_2CO_3
2. Estimation of NaOH/KOH
3. Estimation of oxalic acid.

II. REDOX TITRATIONS

a. Permanganometry

1. Estimation of ferrous ion
2. Estimation of oxalic acid
3. Estimation of sodium oxalate

b. Dichrometry

1. Estimation of ferrous ion
2. Estimation of ferric ion using external indicator

III. IODOMETRY AND IODIMETRY

1. Estimation of potassium dichromate
2. Estimation of potassium permanganate
3. Estimation of copper (ii) ion

IV. EDTA Titration

1. Estimation of total hardness of water
2. Estimation of Calcium.
3. Estimation of Magnesium

Summative Examination at the end of Semester II

Max. Marks –100

Distribution of Marks: Internal – 40 Marks

External – 60 Marks

Duration of Examination: 3 hrs.

Internal

Class Experiments : 40 marks

External examination

Record Notebook : 10 marks

Procedure writing : 10 marks

Experiment : 40 marks

Total : 60 marks

For Estimation, if the student has

< 1% error – 40 marks

1–2% error – 35 marks

2–3% error – 30 marks

3–5% error – 25 marks

> 5% error – 12 marks



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

15

TEXT BOOK:

Vogel's Textbook of Quantitative Inorganic Analysis. 6th Edn. (2006)

REFERENCE BOOK:

Basic Principles of Practical Chemistry by V. Venkatheswaran, R. Veeraswamy and A. R. Kulandaivelu, 2nd Edn. S.Chand and Co. Ltd. (2015).

DIGITAL SOURCES:

1. <https://www.youtube.com/watch?v=V9tAQ12XcHw>
2. <https://www.youtube.com/watch?v=cEOvj6jkdDw>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO	3	3	3	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYS11	MILK SCIENCE	SBS – 1	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

This course aims to provide skill, employability and entrepreneurship to students by giving the knowledge in chemistry of milk and milk products preparation and preservation.

COURSE OBJECTIVES:

This course aims

- To give preliminary idea about composition of milk
- To help the students gain information about the processing of milk
- To help the students learn the various types of milk products
- To study about the special milk products
- To discuss the ice cream, milk powder and fermented milk products.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the physical properties of milk and its composition	Upto K3
CO 2	explain about the physico chemical changes in milk during the various processing of milk	Upto K3
CO 3	know and get knowledge about the different milk products and their preservation	Upto K3
CO 4	recognize the various types of special milks	Upto K3
CO 5	acquire knowledge about the ice-cream, milk powder and fermented milk products	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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MILK SCIENCE

UNIT – I: COMPOSITION OF MILK (6 hrs.)

Milk – definition – general composition of milk – constituents of milk – physical properties of milk – colour, odour, acidity, specific gravity, viscosity and effects of heating – factors affecting the composition of milk.

UNIT – II: PROCESSING OF MILK (6 hrs.)

Microbiology of milk – destruction of microorganisms in milk – physico-chemical changes during processing – pasteurization – definition – types of pasteurization – HTST and UHT – vacuum pasteurization – effects of pasteurization.

UNIT – III: MILK PRODUCTS – I (6 hrs.)

Cream – composition – chemistry of creaming – methods of separation – gravitational and centrifugal separation – estimation of fat in cream.

Butter – composition – desibutter – salted butter – estimation of acidity and moisture content in butter. Ghee – major constituents – common adulterants added to ghee and their detection – rancidity – definition – prevention.

UNIT – IV: MILK PRODUCTS – II (6 hrs.)

Cheese – definition – types – cheddar cheese – cottage cheese – swiss cheese – cheddar cheese manufacturing. Special milk – homogenized milk – flavoured milk – vitaminised milk – toned milk – vegetable toned milk – condensed milk – humanized milk – soft curd milk – low lactose milk.

UNIT – V: MILK PRODUCTS – III (6 hrs.)

Ice cream – definition – percentage – composition – types – manufacture of ice cream – sweeteners – stabilizers – emulsifiers and their role. Milk powder – definition – manufacturing milk powder. Fermented milk products – fermentation of milk – yoghurt – cultured milk – cultured butter milk – acidophilous milk – uses of fermented milk products.

Demonstrations in milk adulteration analysis and casein protein estimation.

TEXT BOOKS:

1. *Industrial Chemistry* by B. K. Sharma, Goel publishing House (2008).
2. *A Text book of Dairy Chemistry* by Saurav Singh, Days Publishing House 1st Edn.(2013)
3. *Text book of Dairy Chemistry* by P.L. Choudhary, Bio- Green book Publishers (2021)

REFERENCE BOOKS:

1. *Applied Chemistry* by K. Bagavathi Sundari, MJP publishers (2008).
2. *Fundamental concepts of Applied Chemistry* by Jeyashree Ghosh, S.Chand and Co. Ltd. (2006).
3. *Dairy Chemistry and Biochemistry* by P.F. Fox and P.L.H. Mesweeney, Springer Second Edn.(2016)

DIGITAL TOOLS:

1. <https://ndc.ie/health-professionals/the-nutritional-composition-of-dairy/>
2. <https://www.youtube.com/watch?v=-FHII993x9A>
3. <https://www.youtube.com/watch?v=21L3LABPqZg>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	1	2	3
CO2	1	2	3	2	3	2
CO3	2	1	2	2	2	2
CO4	2	2	3	3	2	2
CO5	2	1	2	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Prof. K. VASUKI



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COURSE STRUCTURE – II SEMESTER

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT21	Part – I: Tamil – பொதுத் தமிழ் – II	6	3	25	75	100	3
	24UACH21	Hindi – General Hindi – II						
	24UACS21	Sanskrit – Prose, Grammar and History of Sanskrit Literature						
2.	24UACE21	Part – II: English – General English – II	6	3	25	75	100	3
3.	24UCYC21	Part – III: Core – 3 T: General Chemistry–II	5	3	25	75	100	4
4.	24UCYCP1	Part – III: Core – 2 P: Quantitative Inorganic Estimation	3	3	40	60	100	2
5.	24UMSA21/ 24UBYA21	Part – III: Allied 1 – 2 T: Mathematics / Botany	6 / 4	3	25	75	100	5 / 4
6.	24UBYAP1	Part – III: Allied 1 – 1 P: Botany Practical	2	3	40	60	100	2
7.	24UCYS21	Part – IV: SBS – 2 T: Chemistry Behind Laboratory Practices	2	3	25	75	100	2
8.	24UACES1	Part – IV: Environmental Studies	2	3	25	75	100	2
		TOTAL	30				800	23

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

NME – Non –Major Elective

T – Theory

P – Practical



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYC21	GENERAL CHEMISTRY – II	CORE – 3	5	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course makes the students to acquire a thorough knowledge about the concepts of acids and bases, oxidation and reduction, to get the basic knowledge about the properties of gases, surface chemistry and also to gain a detailed study about hydrocarbon chemistry.

COURSE OBJECTIVES:

This course aims at giving an overall view

- To study about the acid base concepts in inorganic chemistry and to study the concepts of oxidation and reduction.
- To give an introductory account of gaseous state
- To discuss the fundamental aspects of catalysis and adsorption.
- To give an introductory account of hydrogen carbon like alkanes, cycloalkanes and their conformation
- To give an introductory account of hydrogen carbon like alkenes, alkadienes and alkynes.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	complete the knowledge of acids–bases, oxidation states & balance redox reactions	Upto K3
CO 2	understand the gas laws and their applications	Upto K3
CO 3	gain the knowledge of catalysis and adsorption	Upto K3
CO 4	explain the chemistry of alkanes, cycloalkanes and conformations of cycloalkanes	Upto K3
CO 5	spell the chemistry of alkenes, alkadienes, alkynes	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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GENERAL CHEMISTRY – II

UNIT – I: BASIC CONCEPTS IN INORGANIC CHEMISTRY (15 hrs.)

Acids and bases: Arrhenius, Bronsted –Lowry, Lewis, Lux–Flood and Usanovich concepts – relative strength of acids and bases – Hard and Soft acids and bases (HSAB) – principle – applications – pH and pOH scales – buffer– calculation of pH of buffer – Henderson's equation.

Oxidation and reduction: Explanation in terms of oxidation number – oxidant and reductant – their equivalent weight calculation – redox reactions – balancing of redox reactions by ion–electron and oxidation number methods.

UNIT – II: GASEOUS STATE (15 hrs.)

Gas Laws – ideal gas equation – kinetic theory of gases : postulates – derivation of ideal gas laws – deviations – van der Waals' equation – types of molecular velocities: average velocity, most probable velocity, root mean square velocity– relationship between these velocities– Maxwell distribution of molecular velocities (no derivation) – graphical representation – effect of temperature on various velocities – law of corresponding states – Boyle and inversion temperatures of gases – mean free path– collision number – collision frequency – equi partition of energy.

UNIT – III: SURFACE CHEMISTRY (15 hrs.)

Catalysis : Definition – characteristics of catalytic reactions –homogeneous catalysis – heterogeneous catalysis – acid–base catalysis–enzyme catalysis–Michaelis–Menten equation–autocatalysis— promoters– catalytic poison – theories of catalysis .

Adsorption: Definition – various terms involved in adsorption – types of adsorption: physical and chemical adsorption – difference between them – factors influencing adsorption – Adsorption Isotherms: Freundlich adsorption isotherm and Langmuir adsorption isotherm (no derivation) – applications of adsorption.

UNIT – IV: HYDROCARBON CHEMISTRY – I (15 hrs.)

- Alkanes: Preparation by Sabatier–Senderen, Wurtz, Corey–House, Kolbe, Duma and reduction methods – general properties.
- Cycloalkanes: Preparation by Freund, Perkin, Wislicenus, Dieckmann, Thorpe–Zeigler and Diels – Alder methods – general properties –stability – Baeyer's strain theory – its modification.
- Conformation: Definition – conformational analysis of ethane, n–butane and cyclohexane.

UNIT – V: HYDROCARBON CHEMISTRY– II (15 hrs.)

- Alkenes: General methods of preparation – properties : electrophilic addition reactions – addition of hydrogen halides– syn – and anti, Markovnikov rule and Kharasch effect – addition of halogens – hydration by oxymercuration and demercuration – hydroboration oxidation – ozonolysis – reduction – substitution reactions –polymerization.
- Alkadienes: Classification – general methods of preparation and properties of 1,3–butadiene, isoprene and chloroprene.
- Alkynes: General methods of preparation – properties – acidic character of acetylene.



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TEXT BOOKS:

1. *Principles of Inorganic Chemistry* by Puri, Sharma and K. C. Kalia, Milestone Publishers 48th Edn. (2019)
2. *Principles of Physical Chemistry* by B. R. Puri, L. R. Sharma & S. Pathania, Vishal Publishing Co. (2022)
3. *Essentials of Physical Chemistry* by B. S. Bahl, Arun Bahl and G. D. Tuli, S. Chand and Co. Ltd. (2016)
4. *Modern Organic Chemistry* by M. K. Jain and S. C. Sharama, Vishal Publishing Co. 4th Edn. (2014)

REFERENCE BOOKS:

1. *Modern Inorganic Chemistry* by R. D. Madan and Satya Prakash, S. Chand and Co, 3rd Edn. (2014)
2. *Advanced Physical Chemistry* by Gurdeep Raj – Krishna Prakashan Media (P) Ltd. 39th Edn. (2014)
3. *Advanced Organic Chemistry* by B. S. Bahl and Arun Bahl, S. Chand Publishing Co. Ltd. (2017)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=DupXDD87oHc>; <https://www.youtube.com/watch?v=jyvcVjrZnJA>
2. <https://www.youtube.com/watch?v=nrXMoGsUuK0>
3. <https://www.youtube.com/watch?v=J8FqEHY2Uvg>
4. <https://www.youtube.com/watch?v=ykIFTtTjoso>; https://www.youtube.com/watch?v=aqVY-ZPhw2Q&list=PLGvozyFU10Y7cBKM00oDmUJW0t_CyQ6e
<https://www.youtube.com/watch?v=qWeR93yC4Ko>
5. <https://www.youtube.com/watch?v=EFjkxmgRMQk>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	2	3	2
CO2	3	1	3	1	3	2
CO3	3	1	3	2	3	2
CO4	3	1	3	2	3	2
CO5	3	1	2	2	3	1

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. N. P. KRISHNAN



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYCP1	QUANTITATIVE INORGANIC ESTIMATION	CORE – 2 PRACTICAL	-	3	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course gives the practical knowledge in volumetric analysis.

COURSE OBJECTIVE:

A double titration involving the making up of the solution is to be estimated and the preparation of primary standard solutions should be carried out.

COURSE OUTCOME (CO):

After the completion of the course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom's Taxonomy)
CO	illustrate the estimation of substance by various types of titration method	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLYING

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard Solution



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QUANTITATIVE INORGANIC ESTIMATION

LIST OF EXPERIEMENTS

I. ACIDMETRY AND ALKALIMETRY

1. Estimation of Na_2CO_3
2. Estimation of NaOH/KOH
3. Estimation of oxalic acid.

II. REDOX TITRATIONS

a. Permanganometry

1. Estimation of ferrous ion
2. Estimation of oxalic acid
3. Estimation of sodium oxalate

b. Dichrometry

1. Estimation of ferrous ion
2. Estimation of ferric ion using external indicator

III. IODOMETRY AND IODIMETRY

1. Estimation of potassium dichromate
2. Estimation of potassium permanganate
3. Estimation of copper (ii) ion

IV. EDTA Titration

1. Estimation of total hardness of water
2. Estimation of Calcium.
3. Estimation of Magnesium

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Summative Examination at the end of Semester II

Max. Marks –100

Distribution of Marks: Internal – 40 Marks
External – 60 Marks

Duration of Examination: 3 hrs.

Internal

Class Experiments : 40 marks

External examination

Record Notebook	: 10 marks
Procedure writing	: 10 marks
Experiment	: 40 marks
Total	: <u>60 marks</u>

For Estimation, if the student has

< 1% error	– 40 marks
1–2% error	– 35 marks
2–3% error	– 30 marks
3–5%error	– 25 marks
> 5% error	– 12 marks



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TEXT BOOK:

Vogel's Textbook of Quantitative Inorganic Analysis 6th Edn. (2006)

REFERENCE BOOK:

Basic Principles of Practical Chemistry by V. Venkatheswaran, R. Veeraswamy and A. R. Kulandaivelu, 2nd Edn. S.Chand and Co. Ltd. (2015).

DIGITAL SOURCES:

1. <https://www.youtube.com/watch?v=V9tAQl2XcHw>
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Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO	3	3	3	3	3	3

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COURSE DESIGNER: Dr. T. S. MANIKANDAN



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COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UCYS21	CHEMISTRY BEHIND LABORATORY PRACTICES	SBS – 2	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	25	75	100

NATURE OF COURSE	Employability	Skill Oriented	Entrepreneurship
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

COURSE DESCRIPTION:

This course instructs the basic awareness about laboratory chemicals, basic norms of inorganic qualitative analysis, principles of titrimetry, chromatography and separation and purification techniques.

COURSE OBJECTIVES:

To make the students

- get awareness on laboratory chemicals and safety
- acquire the thorough knowledge about inorganic qualitative analysis.
- know the principles of volumetric analysis
- learn about the basic principles of various chromatographic techniques
- understand principles of separation and purification techniques.

COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain the knowledge about lab safety methods include safe handling of toxic and poisonous chemicals and provide knowledge about first aid in case of small lab accidents	Upto K3
CO 2	identify the acid radicals and eliminate the interfering acid radicals and basic radical identification	Upto K3
CO 3	apply acidimetric, alkalimetric and redox method for the quantitative volumetric estimation.	Upto K3
CO 4	remember applications of chromatographic techniques	Upto K3
CO 5	examine the lab techniques on purification methods such as sublimation, distillation and crystallization	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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CHEMISTRY BEHIND LABORATORY PRACTICES

UNIT – I: LABORATORY HYGIENE AND SAFETY (6 Hrs.)

Storage and handling of chemicals – carcinogenic chemicals – toxic and poisonous chemicals – waste disposal – fume disposal – general precautions for avoiding accidents – first aid techniques – poisoning – methods to avoid poisoning – treatment for specific poison – antidotes – laboratory safety measures

UNIT – II: INORGANIC QUALITATIVE ANALYSIS (6 Hrs.)

Aim of semi micro methods – types of reactions – dry reactions – precipitation reactions – complexation reactions – oxidation and reduction reactions – flame test, borax bead test, charcoal cavity test and cobalt nitrate test – chemistry of interfering anions and their removal in the analysis of cations: oxalate, borate, fluoride, phosphate and chromate.

UNIT – III: VOLUMETRIC ANALYSIS (6 Hrs.)

TITRIMETRY: Titration – analyte and titrant – equivalence point – molality – molarity – normality – standard solutions: primary and secondary standards – volumetric titrations: types – acid–base titrations (choice of indicator and its theory) – redox titrations (permanganometry, iodometry and iodimetry) and complexometric titrations (EDTA only).

UNIT – IV: CHROMATOGRAPHY (6 Hrs.)

Definition – principle, working and applications of following chromatographic techniques – paper chromatography – column chromatography – thin layer chromatography (TLC) – superiority of TLC over other techniques.

UNIT – V: PURIFICATION TECHNIQUES (6 Hrs.)

Purification methods: Types – criteria of purity – principle – detailed study of crystallisation – sublimation – distillation and its types (steam, fractional and reduced pressure distillations) – extraction techniques.

TEXT BOOKS:

1. *Elements of Analytical Chemistry* by R.Gopalan, P.S. Subramanian and K.Rengarajan, Sultan Chand & Sons, (2000)
2. *Principles of Inorganic Chemistry* by B. R. Puri, L. R. Sharma & K. C. Kalia, Milestone publishers, 48th Edn. (2019).

REFERENCE BOOKS:

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3. *Basic Principles of Practical Chemistry* by V.Venkateswaran, R.Veerasingam & A.R.Kulandaivelu, Sultan Chand & Sons (2002)

DIGITAL TOOLS:

1. <https://www.wpi.edu/offices/environmental-health-safety/laboratory/hygiene>
2. https://en.wikipedia.org/wiki/Qualitative_inorganic_analysis
3. <https://www.britannica.com/science/volumetric-analysis>
4. <https://www.youtube.com/watch?v=CXlmtfxuzQ>

Mapping of CO with PSO

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CO3	3	1	2	3	2	1
CO4	2	2	3	3	2	2
CO5	2	1	2	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN