

SRI SANKARA ARTS AND SCIENCE COLLEGE

[AUTONOMOUS]

AFFILIATED TO UNIVERSITY OF MADRAS

ENATHUR, KANCHIPURAM – 631 561

DEPARTMENT OF CHEMISTRY



SYLLABUS FOR ALLIED CHEMISTRY COURSE

[2023-2024]

UNIVERSITY OF MADRAS

SRI SANKARA ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Syllabus for Allied Chemistry Course.

(Effective from the academic year 2023 – 2024)

Preamble

Chemistry is the branch of science which deals with study of matter, their properties and the energy changes involved during any process. Chemical technologies enrich our quality of life by providing solutions to problems in every field. Hence study of Chemistry prepares the student to meet challenges of the future. Every learner should be encouraged to exchange ideas and thoughts which lead to develop an environment of cognitive in nature and not a one way information flow. Keeping all this in mind, the curriculum under Learning Outcome-based Curriculum Framework (LOCF) is designed.

1.Introduction

Chemistry is the study of composition and transformation of matter. A science that is central to energy production, health care, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in Chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry and specialized courses such as Pharmaceutical Chemistry, spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food chemistry, Dairy Chemistry and so on. Thus, this programme helps learners in building a solid foundation for higher studies in Chemistry. The hands on experience the students gain in Practicals enable them to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship.

The subject Chemistry is designed as Allied for Physics, Bio-Chemistry and Biotechnology by keeping in mind the interest of learners to explore the field of chemistry. The course is planned in such a way that it allows flexibility and innovation in course design, syllabi development, teaching-learning process and quality assessment of students learning levels. The practical

sessions will help the students to gain sufficient skills in Organic compound analysis as well as quantitative analysis. Students are also encouraged to improve their scientific writing skills through various assignments.

2. LOCF

The objectives of the course are to :

- Create interest in learning chemistry; develop knowledge and understanding of chemical concepts, principles, and theories related to chemistry.
- Develop the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in chemistry.
- Develop skills in qualitative and quantitative analysis.

3. Graduate Attributes in Chemistry

Some of the attributes of graduate with Chemistry as one of the subject are :

- **Core competency:** Basic knowledge of fundamental concepts of chemistry and Chemistry
- **Communication skills:** Ability to express thoughts and ideas effectively in writing and orally
- **Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse, evaluate and identify relevant assumptions, critically evaluate practices, policies and theories by following scientific approach to knowledge development
- **Problem-solving:** Expected to be equipped with problem-solving skills.
- **Research-skills:** Ability to define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment

4. Qualification Descriptors

The qualification descriptors for a Bachelor's Degree program with Chemistry as one of the elective or allied subject may include the following:

- Use knowledge, understanding and skills required for identifying problems and issues relating to chemistry.
- Apply one's subject knowledge and transferable skills to identify and analyse problems and issues and solve complex problems with well-defined solutions.
- Address one's own learning needs relating to current and emerging areas of study relating to chemistry.
- Demonstrate subject-related and transferable skills that are relevant to chemistry related job trades and employment opportunities

5. Programme Specific Outcomes (PSO)

5.1 [For B.Sc., Biochemistry]

PSO1: Placement:

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2: Entrepreneur:

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations

PSO3: Research and Development:

Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4: Contribution to Business World:

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO5: Contribution to the Society:

To contribute to the development of the society by collaborating with stake holders for mutual benefit

5.2 [For B.Sc., Physics]

PSO1: Placement:

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2: Entrepreneur:

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations

PSO3: Research and Development:

Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4: Contribution to Business World:

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO5: Contribution to the Society:

To contribute to the development of the society by collaborating with stake holders for mutual benefit

5.3 [For B.Sc., Biotechnology]

PSO1: Disciplinary Knowledge:

Understand the fundamental principles, concepts, and theories related to Biotechnology,. Also, exhibit proficiency in performing experiments in the laboratory.

PSO2: Critical Thinking:

Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively

PSO3: Problem Solving:

Employ theoretical concepts and critical reasoning ability with technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.

PSO4: Analytical & Scientific Reasoning:

Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.

PSO5: Research related skills:

Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.

6. CURRENT SYLLABUS

6.1 ALLIED CHEMISTRY SYLLABUS FOR B.Sc., BIOCHEMISTRY

(w.e.f 2023 – 2024)

(a) ALLIED CHEMISTRY-I

Title of the Paper	ALLIED CHEMISTRY-I					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	I	3	5	60	
Objectives of the course	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> • Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry • Nuclear chemistry and industrial chemistry • Importance of speciality drugs and • Separation and purification techniques. 					
Syllabus						
Units	Contents					No.of Hours
I	<p>UNIT I</p> <p>CHEMICAL BONDING AND NUCLEAR CHEMISTRY</p> <p>Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</p>					12

II	<p>UNIT II</p> <p>INDUSTRIAL CHEMISTRY</p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p>Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</p>	12
III	<p>UNIT III</p> <p>FUNDAMENTAL CONCEPTS IN ORGANIC CHEMISTRY</p> <p>Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆.</p> <p>Polar Effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.</p> <p>Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.</p> <p>Heterocyclic Compounds: Preparation, properties of pyrrole and pyridine.</p>	12
IV	<p>UNIT IV</p> <p>DRUGS AND SPECIALITY CHEMICALS</p> <p>Definition, structure and uses:Antibiotics viz.,Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.</p>	12

V	<p>UNIT V:</p> <p>ANALYTICAL CHEMISTRY</p> <p>Introduction to qualitative and quantitative analysis. Principles of volumetric analysis.</p> <p>Separation and purification techniques: extraction, distillation and crystallization.</p> <p>Chromatography: Principle and application of column, Paper and Thin layer chromatography.</p>	12
TOTAL		60

TEXT BOOKS

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, First edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition,2012.
4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth edition, 2007.

REFERENCE BOOKS

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth edition, 2007.
2. B.K,Sharma, Industrial Chemistry; GOEL Publishing house, Meerut, Sixteenth edition, 2014.
3. Jayashree Gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	State the theories of chemical bonding, nuclear reactions and its applications.
CO-2	Evaluate the efficiencies and uses of various fuels and fertilizers
CO-3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO-4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
CO-5	Analyse various methods to identify an appropriate method for the separation of chemical components.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	3	2	1	3	2
CO3	3	1	2	3	2
CO4	3	2	3	3	2
CO5	3	2	3	2	2
TOTAL	15	10	10	14	10
AVERAGE	3.0	2.0	2.0	2.8	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	1	1	1
CO3	3	2	1	2	2
CO4	3	2	1	2	2
CO5	3	1	2	3	3
TOTAL	15	10	8	10	10
AVERAGE	3.0	2.0	1.6	2.0	2.0

Level of Correlation between PSO's and CO's

(b) ALLIED CHEMISTRY PRACTICAL-I

Title of the Paper	*ALLIED CHEMISTRY PRACTICAL-I					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	I	2	3	24	
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">• Basics of preparation of solutions.• Principles and practical experience of volumetric analysis					
Syllabus						
Practical	Contents					No.of Hours
I	VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator.					24
TOTAL						24
REFERENCE BOOK V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						

* Practical examination will be conducted at the end of SECOND semester.

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

COs.	COURSE OUTCOMES
CO-1	Design, carry out, record and interpret the results of volumetric titration.
CO-2	Analyse the chemical constituents in allied chemical products.
CO-3	Gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO-4	Apply their skill in the analysis of water/hardness

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	1	2
TOTAL	12	12	10	10	8
AVERAGE	3.0	3.0	2.5	2.5	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	1	1
CO3	3	2	3	1	1
CO4	3	3	1	2	2
TOTAL	12	10	10	6	6
AVERAGE	3.0	2.5	2.5	1.5	1.5

Level of Correlation between PSO's and CO's

(c) ALLIED CHEMISTRY-II

Title of the Paper	ALLIED CHEMISTRY-II					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	II	3	5	60	
Objectives of the course	<p>This course aims to provide knowledge on</p> <ul style="list-style-type: none"> • Nomenclature of coordination compounds and carbohydrates. • Amino Acids and Essential elements of biosystem. • Understand the concepts of kinetics and catalysis • Provide fundamentals of electrochemistry and photochemistry. 					
Syllabus						
Units	Contents					No.of Hours
I	<p>UNIT I</p> <p>CO-ORDINATION CHEMISTRY AND WATER TECHNOLOGY</p> <p>Co-ordination Chemistry:</p> <p>Definition of terms - IUPAC Nomenclature- Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.</p> <p>Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques – BOD and COD.</p>					12
II	<p>Unit II</p> <p>CARBOHYDRATES</p> <p>Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose inter conversion. Preparation and properties of sucrose, starch and cellulose.</p>					10

III	<p>UNIT III</p> <p>AMINO ACIDS AND ESSENTIAL ELEMENTS OF BIOSYSTEM</p> <p>Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</p>	12
IV	<p>UNIT IV</p> <p>ELECTROCHEMISTRY</p> <p>Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chromeplating – Types of cells -fuel cells-corrosion and its prevention.</p>	14
V	<p>UNIT V</p> <p>PHOTOCHEMISTRY</p> <p>Grothus - Drapper’s law and Stark-Einstein’s law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).</p>	12
TOTAL		60
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, First edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 		

3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition,2012.
4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth edition, 2007.

REFERENCE BOOKS

1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition, 2012.
2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & Sons, New Delhi, Twenty ninth edition, 2007.
3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth edition, 2007.
4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, Forty seventh edition, 2018.
5. B.K,Sharma, Industrial Chemistry; GOEL Publishing house,Meerut, Sixteenth edition, 2014.

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
CO-2	Explain the preparation and property of carbohydrate.
CO-3	Enlighten the biological role of transition metals, amino acids and nucleic acids.
CO-4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CO-5	Outline the various type of photochemical process.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	3	2	1	3	2
CO3	3	1	2	3	2
CO4	3	2	3	3	2
CO5	3	2	3	2	2
TOTAL	15	10	10	14	10
AVERAGE	3.0	2.0	2.0	2.8	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	1	1	1
CO3	3	2	1	2	2
CO4	3	2	1	2	2
CO5	3	1	2	3	3
TOTAL	15	10	8	10	10
AVERAGE	3.0	2.0	1.6	2.0	2.0

Level of Correlation between PSO's and CO's

(d) ALLIED CHEMISTRY PRACTICAL-II

Title of the Paper	ALLIED CHEMISTRY PRACTICAL-II					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	II	2	3	24	
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">• Identification of organic functional groups• Different types of organic compounds with respect to their properties.• Determination of elements in organic compounds.					
Syllabus						
Practical	Contents					No.of Hours
I	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: <ul style="list-style-type: none">(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].(b) Detection of elements (N, S, Halogens).(c) To distinguish between aliphatic and aromatic compounds.(d) To distinguish – Saturated and unsaturated compounds.					24
TOTAL						24
REFERENCE BOOK V.Venkateswaran, R.Veeramy, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

COs.	COURSE OUTCOMES
CO-1	Analyse aliphatic and aromatic property of organic compounds.
CO-2	Apply their skill in the detection of special elements.
CO-3	Analyse saturated and unsaturated nature of organic compounds
CO-4	Analyse the presence of functional groups.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	1	2
TOTAL	12	12	10	10	8
AVERAGE	3.0	3.0	2.5	2.5	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	1	1
CO3	3	2	3	1	1
CO4	3	3	1	2	2
TOTAL	12	10	10	6	6
AVERAGE	3.0	2.5	2.5	1.5	1.5

Level of Correlation between PSO's and CO's

6.2 ALLIED CHEMISTRY SYLLABUS FOR B.Sc., BIOTECHNOLOGY
w.e.f (2023 – 2024)

(a) ALLIED CHEMISTRY

Title of the Paper	ALLIED CHEMISTRY					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	I	3	5	60	
Objectives of the course	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> • Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry • Nuclear chemistry and industrial chemistry • Importance of speciality drugs • Separation and purification techniques. 					
Syllabus						
Units	Contents					No.of Hours
I	<p>UNIT I</p> <p>CHEMICAL BONDING AND NUCLEAR CHEMISTRY</p> <p>Chemical Bonding: Molecular Orbital Theory-bonding, anti bonding and non-bonding orbitals. M.O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law.Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</p>					12

II	<p>Unit II</p> <p>INDUSTRIAL CHEMISTRY</p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p>Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</p>	12
III	<p>UNIT III</p> <p>FUNDAMENTAL CONCEPTS IN ORGANIC CHEMISTRY</p> <p>Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆.</p> <p>Polar Effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.</p> <p>Reaction Mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.</p> <p>Heterocyclic Compounds: Preparation, properties of pyrrole and pyridine.</p>	12
IV	<p>UNIT IV</p> <p>DRUGS AND SPECIALITY CHEMICALS</p> <p>Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.</p>	12

V	<p>UNIT V:</p> <p>ANALYTICAL CHEMISTRY</p> <p>Introduction qualitative and quantitative analysis. Principles of volumetric analysis.</p> <p>Separation and purification techniques: extraction, distillation and crystallization.</p> <p>Chromatography: principle and application of column, paper and thin layer chromatography.</p>	12
TOTAL		60
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, First edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth edition, 2007. 		
<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth edition, 2007. 2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth edition, 2014. 3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006. 		

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	State the theories of chemical bonding, nuclear reactions and its applications.
CO-2	Evaluate the efficiencies and uses of various fuels and fertilizers
CO-3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO-4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
CO-5	Analyse various methods to identify an appropriate method for the separation of chemical components.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	3	2	1	3	2
CO3	3	1	2	3	2
CO4	3	2	3	3	2
CO5	3	2	3	2	2
TOTAL	15	10	10	14	10
AVERAGE	3.0	2.0	2.0	2.8	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	1	1
CO3	3	3	3	2	2
CO4	3	3	3	2	2
CO5	3	2	3	3	3
TOTAL	15	14	15	10	10
AVERAGE	3.0	2.8	3.0	2.0	2.0

Level of Correlation between PSO's and CO's

(b) ALLIED CHEMISTRY PRACTICAL

Title of the Paper	*ALLIED CHEMISTRY PRACTICAL					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	I	I	2	3	30	
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">• Basics of preparation of solutions.• Principles and practical experience of volumetric analysis• Identification of organic functional groups• Different types of organic compounds with respect to their properties.• Determination of elements in organic compounds.					
Syllabus						
Practical	Contents					No.of Hours
I	VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide.					15
II	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: (a) Functional group tests [Acids (mono & di) amides (mono & di), aldehyde and glucose]. (b) Detection of elements (N, S, Halogens). (c) To distinguish between aliphatic and aromatic compounds. (d) To distinguish – Saturated and unsaturated compounds..					15
TOTAL						30

REFERENCE BOOK

V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

* Practical examination will be conducted at the end of SECOND semester.

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	Design, carry out, record and interpret the results of volumetric titration.
CO-2	Analyse the chemical constituents in allied chemical products.
CO-3	Apply their skill in the detection of special elements.
CO-4	Analyse the presence of functional groups.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	1	2
TOTAL	12	12	10	10	8
AVERAGE	3.0	3.0	2.5	2.5	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	2	2
CO3	3	2	3	2	2
CO4	3	3	1	2	2
TOTAL	12	10	10	8	8
AVERAGE	3.0	2.5	2.5	2.0	2.0

Level of Correlation between PSO's and CO's

6.3 ALLIED CHEMISTRY SYLLABUS FOR B.Sc., PHYSICS

(w.e.f 2023 – 2024)

(a) ALLIED CHEMISTRY -I

Title of the Paper	ALLIED CHEMISTRY -I					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	II	III	3	5	60	
Objectives of the course	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> • Basics of atomic orbitals, chemical bonds, hybridization • Concepts of thermodynamics and its applications. • Concepts of nuclear chemistry • Importance of chemical industries • Qualitative and analytical methods. 					
Syllabus						
Units	Contents					No.of Hours
I	<p>UNIT I</p> <p>CHEMICAL BONDING AND NUCLEAR CHEMISTRY</p> <p>Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.</p>					12

II	<p>Unit II</p> <p>INDUSTRIAL CHEMISTRY</p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p>Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</p>	12
III	<p>UNIT III</p> <p>FUNDAMENTAL CONCEPTS IN ORGANIC CHEMISTRY</p> <p>Hybridization: Orbital overlap, hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples.</p> <p>Reaction Mechanisms: Types of reactions—aromaticity (Huckel’s rule)—aromatic electrophilic substitution; nitration, halogenation, Friedal-Craft’s alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine</p>	12
IV	<p>UNIT IV</p> <p>THERMODYNAMICS AND PHASE EQUILIBRIA</p> <p>Thermodynamics:</p> <p>Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot’s cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy.</p> <p>Phase Equilibria: Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).</p>	12

V	<p>UNIT V:</p> <p>ANALYTICAL CHEMISTRY</p> <p>Introduction-qualitative and quantitative analysis.Principles of volumetric analysis.</p> <p>Separation and purification techniques: extraction, distillation and crystallization.</p> <p>Chromatography: principle and application of column, paper and thin layer chromatography.</p>	12
TOTAL		60
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, First edition,2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. Arun Bahl, 3. B.S. Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition,2012. 4. P.L.Soni, H.M. Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth edition, 2007. 		
<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. P.L.Soni, Mohan Katyal, Textbook of Inorganic Chemistry; Sultan Chand and Company,New Delhi, twentieth edition, 2007. 2. B.R.Puri ,L.R. Sharma, M.S.Pathania, Textbook Of Physical Chemistry; Vishal Publishing Co., New Delhi, Forty seventh edition, 2018. 3. B.K,Sharma, Industrial Chemistry; GOEL Publishing house,Meerut,Sixteenth edition, 2014. 		

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
CO-2	Evaluate the efficiencies and uses of various fuels and fertilizers
CO-3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO-4	Apply various thermodynamic principles, systems and phase rule.
CO-5	Explain various methods to identify an appropriate method for the separation of chemical components.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	3	2	1	3	2
CO3	3	1	2	3	2
CO4	3	2	3	3	2
CO5	3	2	3	2	2
TOTAL	15	10	10	14	10
AVERAGE	3.0	2.0	2.0	2.8	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	1	1	1
CO3	3	2	1	2	2
CO4	3	2	1	2	2
CO5	3	1	2	3	3
TOTAL	15	10	8	10	10
AVERAGE	3.0	2.0	1.6	2.0	2.0

Level of Correlation between PSO's and CO's

(b) ALLIED CHEMISTRY PRACTICAL-I

Title of the Paper	*ALLIED CHEMISTRY PRACTICAL-I					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	II	III	2	3	24	
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">• Basics of preparation of solutions.• Principles and practical experience of volumetric analysis					
Syllabus						
Practical	Contents					No.of Hours
I	VOLUMETRIC ANALYSIS 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator.					24
TOTAL						24
REFERENCE BOOK V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						

* Practical examination will be conducted at the end of FOURTH semester.

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

COs.	COURSE OUTCOMES
CO-1	Design, carry out, record and interpret the results of volumetric titration.
CO-2	Analyse the chemical constituents in allied chemical products.
CO-3	Gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO-4	Apply their skill in the analysis of water/hardness

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	1	2
TOTAL	12	12	10	10	8
AVERAGE	3.0	3.0	2.5	2.5	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	1	1
CO3	3	2	3	1	1
CO4	3	3	1	2	2
TOTAL	12	10	10	6	6
AVERAGE	3.0	2.5	2.5	1.5	1.5

Level of Correlation between PSO's and CO's

(c) ALLIED CHEMISTRY -II

Title of the Paper		ALLIED CHEMISTRY - II				
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	II	IV	3	5	60	
Objectives of the course	This course aims to provide knowledge on <ul style="list-style-type: none">• Co-ordination Chemistry and Water Technology• Carbohydrates and Amino acids• Basics and applications of electrochemistry• Basics and applications of kinetics and catalysis• Various photochemical phenomenon					
Syllabus						
Units	Contents					No.of Hours
I	UNIT I CO-ORDINATION CHEMISTRY AND WATER TECHNOLOGY Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature- Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques – BOD and COD.					12

II	<p>Unit II</p> <p>CARBOHYDRATES AND AMINO ACIDS</p> <p>Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose inter conversion. Properties of starch and cellulose.</p> <p>Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</p>	12
III	<p>UNIT III</p> <p>ELECTROCHEMISTRY</p> <p>Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.</p>	12
IV	<p>UNIT IV</p> <p>KINETICS AND CATALYSIS</p> <p>Order and molecularity. Integrated rate expression for I and II (2A →Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Concept of energy of activation and Arrhenius equation.</p> <p>Catalysis-homogeneous and heterogeneous, catalyst used in Contact and Haber’s processes.</p>	12

V	<p>UNIT V</p> <p>PHOTOCHEMISTRY</p> <p>Grothus-Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).</p>	12
TOTAL		60
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, First edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, Twenty third edition,2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth edition, 2007. 		
<p>REFERENCE BOOK</p> <ol style="list-style-type: none"> 1.Arun P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, Forty seventh edition,2018. 3.B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth edition, 2014 		

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

CO No.	COURSE OUTCOMES
CO-1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
CO-2	Explain the preparation and property of carbohydrate, amino acids and nucleic acids.
CO-3	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CO-4	Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.
CO-5	Outline the various type of photochemical process.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	3	2	1	3	2
CO3	3	1	2	3	2
CO4	3	2	3	3	2
CO5	3	2	3	2	2
TOTAL	15	10	10	14	10
AVERAGE	3.0	2.0	2.0	2.8	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	1	1
CO3	3	3	3	2	2
CO4	3	3	3	2	2
CO5	3	2	3	3	3
TOTAL	15	14	15	10	10

AVERAGE	3.0	2.8	3.0	2.0	2.0
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Level of Correlation between PSO's and CO's

(d) ALLIED CHEMISTRY PRACTICAL-II

Title of the Paper	ALLIED CHEMISTRY PRACTICAL-II					
Category of the course	Year	Semester	Credits	Instructional hours per week	Hours	Course code
Allied	II	IV	2	3	24	
Objectives of the course	<p>This course aims to provide knowledge on the</p> <ul style="list-style-type: none"> • Identification of organic functional groups • Different types of organic compounds with respect to their properties. • Determination of elements in organic compounds.... 					
Syllabus						
Practical	Contents					No.of Hours
I	<p>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</p> <p>The analysis must be carried out as follows:</p> <p>(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].</p> <p>(b) Detection of elements (N, S, Halogens).</p> <p>(c) To distinguish between aliphatic and aromatic compounds</p> <p>(d)To distinguish – Saturated and unsaturated compounds..</p>					24
TOTAL						24
REFERENCE BOOK						
<p>V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.</p>						

COURSE OUTCOMES (CO)

On the completion of the course, students will be able to:

COs.	COURSE OUTCOMES
CO-1	Analyse aliphatic and aromatic property of organic compounds.
CO-2	Apply their skill in the detection of special elements.
CO-3	Analyse saturated and unsaturated nature of organic compounds
CO-4	Analyse the presence of functional groups.

CO-PO MAPPING

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	3	3	2	3	2
CO4	3	3	3	1	2
TOTAL	12	12	10	10	8
AVERAGE	3.0	3.0	2.5	2.5	2.0

Level of Correlation between PO's and CO's

CO-PSO MAPPING

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	1	1
CO3	3	2	3	1	1
CO4	3	3	1	2	2
TOTAL	12	10	10	6	6
AVERAGE	3.0	2.5	2.5	1.5	1.5

Level of Correlation between PSO's and CO's

7. Teaching-Learning Process

A number of appropriate assessment methods of Chemistry will be used to determine the extent to which students demonstrate desired learning outcomes. Following assessment methodology should be adopted;

- Oral and written tests.
- Problem-solving exercises.
- Power point presentations.
- Practical assignments and laboratory reports.
- Observation of practical skills.
- Individual and group project reports.
- Peer group learning.
- Seminar presentations,

8. Assessment Methods

Evaluation Pattern: Written Examinations

- Assessments are divided into two parts: Continuous Internal Assessment (CIA) & End Semester Examination.
- Three CIA examinations are conducted for each semester.
- For Internal Evaluation (25 Marks).
- The Semester End Examination shall be conducted at the end of each semester.
- End Semester Examination (external) (75 Marks)- Duration: 3 hours

Internal Evaluation

Course	Assessment	Marks
Theory	Tests (best 2 out of 3)	10
	Attendance	5
	Seminar	5
	Assignment	5
	Total	25
Practical	Tests (best 2 out of 3)	30
	Attendance	5
	Record	5
	Total	40

9. Keywords.

Chemical bonding , Isotopes, isotones, silicones, , fuels, drugs, carbohydrates, amino acids, first and second law of thermodynamics, photochemistry, kinetics, distillation, crystallization etc.