

SRI SANKARA ARTS AND SCIENCE COLLEGE

[AUTONOMOUS]

AFFILIATED TO UNIVERSITY OF MADRAS

ENATHUR, KANCHIPURAM – 631 561

DEPARTMENT OF CHEMISTRY



SYLLABUS FOR ALLIED CHEMISTRY COURSE

[2022-2023]

Syllabus for Allied Chemistry Course [2022-2023]

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

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 programme with Chemistry as one of the 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 (POS)

5.1 [For B.Sc., Biochemistry]

PSO-1; Comprehending fundamental concepts in Biochemistry to enhance knowledge in theoretical aspects

PSO-2; Understanding and acquiring skills in performing laboratory experiments.

PSO-3; Inculcating research motivation among student community and boosting them to pursue higher studies in Biochemistry

PSO-4; Contribution to the betterment of the student community by inculcating sound knowledge in the clearance of competitive exams.

PSO-5; Facilitate the development of skills based on current trends in versatile fields by offering Job oriented certificate courses and Value-added courses

5.2 [For B.Sc., Physics]

PSO-1: This course provides the students to acquire the fundamental concepts of Physics, including the major premises of Mechanics, Thermal Physics, Optics, Atomic and Molecular physics, quantum mechanics, Electronics etc. and also students are also expected to develop a written and oral communication skills in communicating physics-related topics.

PSO-2: Apply conceptual understanding of physics to general real-world situations and describe the methodology of science and the relationship between observation and theory.

PSO-3: Students should learn how to design and conduct a series of experiments demonstrating their understanding of the scientific method and processes and also expected to have an understanding of the analytical methods.

PSO-4: Apply one's knowledge of Physics theoretical and laboratory skills to new/unfamiliar contexts to identify and analyze problems and issues and solve complex problems in Physics and related areas with well-defined solutions.

PSO-5: The outcome of the course would enlighten the students with the fundamental of Classical and modern physics to grow as a medical physicist, Technical and scientific assistants and also prepare them for the competitive exam related to physics for their higher studies.

5.3 [For B.Sc., Biotechnology]

PSO-1; Enriching the Biotechnology knowledge in theoretical aspects at under graduate level

PSO-2; Enriching the Biotechnology knowledge in practical aspects at under graduate level

PSO-3; Developing research aptitude among the student community and encouraging them to pursue higher studies in Biotechnology

PSO-4; Designing the syllabus in the manner which enables students to clear competitive exams in the life sciences

PSO-5; Developing the student skills based on current trends in Biotechnology field by offering Job oriented certificate courses and Value-added courses

6. Current Syllabus

6.1 Allied Chemistry Syllabus for B.Sc., Biochemistry (w.e.f year 2022-2023)

(a) Allied Chemistry - I

Title of the Paper	ALLIED CHEMISTRY - I			
Category of the course	Year	Semester	Credits	Hours
ALLIED	I	I	3	60
Objectives of the course	<ul style="list-style-type: none"> To know the fundamental of nuclear chemistry, thermodynamics and chemical kinetics. To understand the basic concepts of organic chemistry and photochemistry. 			

Syllabus				
Units	Contents	Hours	COs	Cognitive levels
I	<p>NUCLEAR CHEMISTRY</p> <p>Fundamental particles of nucleus, isotopes, isobars, isotones and mirror nuclei – differences between chemical reactions and nuclear reactions. Fusion and fission – Radioactive series, group displacement law – Mass defect – Nuclear binding energy calculation - Applications of radioisotopes in Radio-carbon dating. Safety Disposal of Hazardous waste- Low level and High-level waste – General methods for disposal of nuclear waste (dilution, storage & reclamation only)</p>	12 Hr	CO1	K1,K2,K4,
	<p>INDUSTRIAL CHEMISTRY</p> <p>Fuels- Characteristics and Calorific value, Classification- gaseous fuels like water gas, producer gas, and liquefied petroleum gas (LPG), gobar gas, and compressed natural gas.</p> <p>Fertilizers– Role of NPK fertilizers – Urea,</p>			

II	<p>Ammonium sulphate, Superphosphate, Triple super phosphate, Potassium nitrate– manufacture. Silicones– Synthesis, properties and uses. Hardness of water–Temporary, permanent hardness and disadvantages of hard water – Softening of hard water – Zeolite process, demineralization process and desalination process– reverse osmosis – Purification of water for domestic use: use of chlorine, Ozone and UV light. Definition and determination of BOD and COD.</p> <p>Polymers – Natural and synthetic polymers, Thermosetting and Thermo plastic polymers - Degradable and Non-degradable polymers. Poly alkenes preparation and uses (PET, PVC and PTFE Only).</p>	14Hr	CO2	K1,K2,K3,K6
III	<p>FUNDAMENTALS OF ORGANIC CHEMISTRY Classification of organic compounds – Hybridization in methane, ethylene, acetylene, and benzene. Definition with examples – electrophiles, nucleophiles, carbenes and free radicals. Types of reactions: substitution, addition, elimination and condensation. (one example each)-polar effects- Inductive effect and resonance. Electrophilic substitution reaction in benzene (sulphonation, nitration, alkylation and acylation) Optical isomerism - symmetry, elements of symmetry – Cause of optical activity, Optical isomers of tartaric acid, Racemisation, Resolution by salt formation method – Geometric isomerism of maleic and fumaric acids. – Keto-enol tautomerism in acetoacetic ester.</p>	12Hr	CO3	K1,K2,K4,K6
IV	<p>THERMODYNAMICS Terminology of thermodynamics – Types of systems, Reversible, irreversible, isothermal, adiabatic processes, exothermic and endothermic reactions – Spontaneous processes – First law of thermodynamics – Need for the second law – different statements of second law – Carnot cycle – Efficiency –Free energy and its significance</p>	10Hr	CO4	K1,K2,K5

V	<p>KINETICS AND PHOTOCHEMISTRY:</p> <p>Rate – factors influencing rate of reactions – order and molecularity –integrated rate expression for first and zero order reactions, second order reactions with examples (no derivation) –Half life period – Pseudo first order reaction, methods to determine order of the reaction, Effect of temperature on rate – concept of activation energy – Arrhenius equation.</p> <p>Laws of photochemistry – Grothus Draper law, Stark Einstein law, quantum yield, Hydrogen-Chlorine reaction (Elementary idea only) Photo physical process - Jablonskii diagram. Fluorescence, Phosphorescence, photosynthesis, Chemiluminescence, Photosensitisation – Definition with examples.</p>	12Hr	CO5	K1,K2,K3,K5
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 1. Veeraiyan, V. Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006. (Both in Tamil and English). 2. Vaithyanathan, S. and Others, Textbook of Ancillary Chemistry, Priya Publications, Karur-2. Edition-2006. <p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. Soni, P. L. and Others, Textbook of Organic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006. 2. Soni, P. L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006. 3. Lee, J. D. Concise Inorganic chemistry. UK, Black well science (2006). 4. Puri, B. R., Sharma, L. R., Kabia, K. K. Principles of Inorganic Chemistry (23rd edition) New Delhi, Shoban lal Nagin Chand & co (1993) 5. Puri, B. R, Sharma L. R, Pathania M.S., Principles of physical chemistry, Vishal Publishing Co 2006. 6. Jain, P.C. and others, Engineering Chemistry, Dhanpat Rai publishing company, New Delhi, Edition 2009. 7. Negi, A.S. and Anand, S.C., 2001. A text book of physical chemistry. Taj Press, New Delhi. 				

(b) Allied Chemistry - II

Title of the Paper	ALLIED CHEMISTRY - II			
Category of the course	Year	Semester	Credits	Hours
ALLIED	I	II	3	60
Objectives of the course	<ul style="list-style-type: none">• To understand the fundamental of coordination chemistry and its application.• To explain the basics of Electrochemistry and Analytical chemistry.			

Syllabus				
Units	Contents	Hours	COs	Cognitive levels
I	<p>COORDINATION CHEMISTRY</p> <p>IUPAC Nomenclature of mononuclear complexes, Types of ligands including EDTA. Werner's theory, Sidgwick's EAN Rule, Pauling's theory – Explanation of shapes and magnetic nature of $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Co}(\text{CN})_6]^{3-}$, $[\text{Ni}(\text{CO})_4]$ and $[\text{CoF}_6]^{3-}$. Chelation - EDTA and its applications – Applications of co-ordination of compounds: Qualitative analysis - separation of copper and cadmium ions using KCN, identification of metal ions like Cu and Fe- quantitative analysis, estimation of Nickel using DMG and estimation of aluminium using oxine. Determination hardness of water using EDTA – Biologically important chelates – Haemoglobin and Chlorophyll (preliminary idea only)</p>	12 Hr	CO 1	K1,K2, K4,K5

II	<p>BIOMOLECULES</p> <p>Classifications of carbohydrates – Preparation and properties of Glucose and Fructose – Discussion of open and ring structure of glucose. Mutarotation. Inter conversion of glucose into fructose and vice versa. Properties of sucrose, starch, cellulose and uses of cellulose derivatives.</p> <p>Classification of amino acids – preparation and properties of glycine – peptide bond– preparation of dipeptide using Bergman method. Proteins – classification, properties and its biological functions. RNA and DNA (elementary idea only)</p>	12 Hr	CO 2	K1,K2, K3,K5
III	<p>CHEMOTHERAPY</p> <p>Preparation, uses and mode of action of sulpha drugs – Prontosil, Sulphadiazine and Sulphafurazole. Uses of Pencillin, Chloramphenicol and Streptomycin – Definition with one example for analgesics, antipyretics, tranquilisers, sedatives, hypnotics and local and general anaesthetics. Cause and treatment of diabetes, cancer and AIDS</p>	12 Hr	CO 3	K1,K2,K3
IV	<p>ELECTROCHEMISTRY</p> <p>Electrolytes – strong and weak –conductance and their types – Measurement of conductance. Kohlraush’s law – calculation of λ_0 of weak electrolyte (acetic acid and ammonium hydroxide). Conductometric titrations-strong acid vs strong base.</p> <p>Types of reversible electrodes – Galvanic cell – EMF – Measurement of EMF – Standard electrode potential, Nernst equation, reference electrodes – standard hydrogen electrode and calomel electrode. pH – definition, measurement by using glass electrode and its application. Secondary cell – Lead accumulators. Corrosion and its prevention</p>	12 Hr	CO 4	K1,K2, K4,K6,

V	<p>ANALYTICAL CHEMISTRY</p> <p>Volumetric analysis – Normality, molarity and molality, primary and secondary standards – principles of volumetric analysis.</p> <p>Extraction – Soxhlet extraction using immiscible solvents. Purification – crystallization, fractional crystallization and sublimation. Distillation – fractional distillation, vacuum distillation and steam distillation.</p> <p>Chromatography – Principles, techniques and applications – R_f value - Column chromatography – Paper chromatography – TLC, Gas chromatography (GC) and high pressure liquid chromatography (HPLC).</p>	12 Hr	CO 5	K1,K2,K3 K5,K6
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TEXT BOOKS

1. Veeraiyan V. Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006. (Both in Tamil and English).
2. Vaithyanathan S. and Others, Textbook of Ancillary Chemistry, Priya Publications, Karur-2. Edition-2006.

REFERENCE BOOKS

1. Soni, P. L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
2. Soni, P. L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Lee, J. D. Concise Inorganic chemistry. UK, Black well science (2006).
4. Puri, B. R., Sharma L.R., Kabia K.K. Principles of Inorganic Chemistry (23rd edition) New Delhi, Shoban lal Nagin Chand & co (1993)
5. Puri, B.R, Sharma L.R, Pathania M.S., Principles of physical chemistry, Vishal Publishing Co 2006.
6. Jain, P.C. and others, Engineering Chemistry, Dhanpat Rai publishing company, New Delhi, Edition 2009.
7. Negi, A.S. and Anand, S.C., 2001. A text book of physical chemistry. Taj Press., New Delhi.
8. Gopalan, R., Subramanian, P.S., Rangarajan, K. Analytical Chemistry.

6.2 Allied Chemistry Syllabus for B.Sc Physics (w.e.f year 2022-2023)

(a) Allied Chemistry - I

Title of the Paper	ALLIED CHEMISTRY - I			
Category of the course	Year	Semester	Credits	Hours
ALLIED	II	III	3	60
Objectives of the course	<ul style="list-style-type: none"> To know the fundamental of nuclear chemistry, thermodynamics and chemical kinetics. To understand the basic concepts of organic chemistry and photochemistry. 			

Syllabus				
Units	Contents	Hours	COs	Cognitive levels
I	<p>NUCLEAR CHEMISTRY</p> <p>Fundamental particles of nucleus, isotopes, isobars, isotones and mirror nuclei – differences between chemical reactions and nuclear reactions. Fusion and fission – Radioactive series, group displacement law – Mass defect – Nuclear binding energy calculation - Applications of radioisotopes in Radio-carbon dating. Safety Disposal of Hazardous waste- Low level and High-level waste – General methods for disposal of nuclear waste (dilution, storage & reclamation only)</p>	12 Hr	CO1	K1,K2,K4,

II	<p>INDUSTRIAL CHEMISTRY</p> <p>Fuels- Characteristics and Calorific value, Classification- gaseous fuels like water gas, producer gas, and liquefied petroleum gas (LPG), gobar gas, and compressed natural gas.</p> <p>Fertilizers- Role of NPK fertilizers – Urea, Ammonium sulphate, Superphosphate, Triple super phosphate, Potassium nitrate- manufacture.</p> <p>Silicones- Synthesis, properties and uses.</p> <p>Hardness of water-Temporary, permanent hardness and disadvantages of hard water – Softening of hard water – Zeolite process, demineralization process and desalination process- reverse osmosis – Purification of water for domestic use: use of chlorine, Ozone and UV light. Definition and determination of BOD and COD.</p> <p>Polymers – Natural and synthetic polymers, Thermosetting and Thermo plastic polymers - Degradable and Non-degradable polymers. Poly alkenes preparation and uses (PET, PVC and PTFE Only).</p>	14Hr	CO2	K1,K2,K3,K6
III	<p>FUNDAMENTALS OF ORGANIC CHEMISTRY</p> <p>Classification of organic compounds – Hybridization in methane, ethylene, acetylene, and benzene. Definition with examples – electrophiles, nucleophiles, carbenes and free radicals. Types of reactions: substitution, addition, elimination and condensation. (one example each)-polar effects- Inductive effect and resonance. Electrophilic substitution reaction in benzene (sulphonation, nitration, alkylation and acylation)</p> <p>Optical isomerism - symmetry, elements of symmetry – Cause of optical activity, Optical isomers of tartaric acid, Racemisation, Resolution by salt formation method – Geometric isomerism of maleic and fumaric acids. – Keto-enol tautomerism in acetoacetic ester.</p>	12Hr	CO3	K1,K2,K4,K6

IV	<p>THERMODYNAMICS</p> <p>Terminology of thermodynamics – Types of systems, Reversible, irreversible, isothermal, adiabatic processes, exothermic and endothermic reactions – Spontaneous processes – First law of thermodynamics – Need for the second law – different statements of second law – Carnot cycle – Efficiency – Free energy and its significance</p>	10Hr	CO4	K1,K2,K5
V	<p>KINETICS AND PHOTOCHEMISTRY:</p> <p>Rate – factors influencing rate of reactions – order and molecularity – integrated rate expression for first and zero order reactions, second order reactions with examples (no derivation) – Half life period – Pseudo first order reaction, methods to determine order of the reaction, Effect of temperature on rate – concept of activation energy – Arrhenius equation.</p> <p>Laws of photochemistry – Grothus Draper law, Stark Einstein law, quantum yield, Hydrogen-Chlorine reaction (Elementary idea only) Photo physical process - Jablonskii diagram. Fluorescence, Phosphorescence, photosynthesis, Chemiluminescence, Photosensitisation – Definition with examples.</p>	12Hr	CO5	K1,K2,K3,K5
<p>TEXT BOOKS</p> <ol style="list-style-type: none"> 3. Veeraiyan, V. Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006. (Both in Tamil and English). 4. Vaithyanathan, S. and Others, Textbook of Ancillary Chemistry, Priya Publications, Karur-2. Edition-2006. <p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. Soni, P. L. and Others, Textbook of Organic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006. 2. Soni, P. L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006. 3. Lee, J. D. Concise Inorganic chemistry. UK, Black well science (2006). 4. Puri, B. R., Sharma, L. R., Kabia, K. K. Principles of Inorganic Chemistry (23rd edition) New Delhi, Shoban lal Nagin Chand & co (1993) 5. Puri, B. R, Sharma L. R, Pathania M.S., Principles of physical chemistry, Vishal Publishing Co 2006. 6. Jain, P.C. and others, Engineering Chemistry, Dhanpat Rai publishing company, New Delhi, Edition 2009. 7. Negi, A.S. and Anand, S.C., 2001. A text book of physical chemistry. Taj Pres 				

(b) Allied Chemistry - II

Title of the Paper	ALLIED CHEMISTRY - II			
Category of the course	Year	Semester	Credits	Hours
ALLIED	II	IV	3	60
Objectives of the course	<ul style="list-style-type: none">• To understand the fundamental of coordination chemistry and its application.• To explain the basics of Electrochemistry and Analytical chemistry.			

Syllabus				
Units	Contents	Hours	COs	Cognitive levels
I	COORDINATION CHEMISTRY IUPAC Nomenclature of mononuclear complexes, Types of ligands including EDTA. Werner's theory, Sidgwick's EAN Rule, Pauling's theory – Explanation of shapes and magnetic nature of $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Co}(\text{CN})_6]^{3-}$, $[\text{Ni}(\text{CO})_4]$ and $[\text{CoF}_6]^{3-}$. Chelation - EDTA and its applications – Applications of co-ordination of compounds: Qualitative analysis - separation of copper and cadmium ions using KCN, identification of metal ions like Cu and Fe- quantitative analysis, estimation of Nickel using DMG and estimation of aluminium using oxine. Determination hardness of water using EDTA –	12 Hr	CO 1	K1,K2,

	Biologically important chelates – Haemoglobin and Chlorophyll (preliminary idea only)			K4,K5
II	<p>BIOMOLECULES</p> <p>Classifications of carbohydrates – Preparation and properties of Glucose and Fructose – Discussion of open and ring structure of glucose. Mutarotation. Inter conversion of glucose into fructose and vice versa. Properties of sucrose, starch, cellulose and uses of cellulose derivatives.</p> <p>Classification of amino acids – preparation and properties of glycine – peptide bond– preparation of dipeptide using Bergman method. Proteins – classification, properties and its biological functions. RNA and DNA (elementary idea only)</p>	12 Hr	CO 2	K1,K2,K3, K5
III	<p>CHEMOTHERAPY</p> <p>Preparation, uses and mode of action of sulphadiazine, Sulphadiazine and Sulphafurazole. Uses of Penicillin, Chloramphenicol and Streptomycin – Definition with one example for analgesics, antipyretics, tranquilisers, sedatives, hypnotics and local and general anaesthetics. Cause and treatment of diabetes, cancer and AIDS</p>	12 Hr	CO 3	K1,K2,K3, K5,
IV	<p>ELECTROCHEMISTRY</p> <p>Electrolytes – strong and weak –conductance and their types – Measurement of conductance. Kohlraush's law – calculation of λ_0 of weak electrolyte (acetic acid and ammonium hydroxide). Conductometric titrations-strong acid vs strong base.</p> <p>Types of reversible electrodes – Galvanic cell – EMF – Measurement of EMF – Standard electrode potential, Nernst equation, reference electrodes – standard hydrogen electrode and calomel electrode. P^H – definition, measurement by using glass electrode and its application. Secondary cell – Lead accumulators. Corrosion and its prevention</p>	12 Hr	CO 4	K1,K2,K4 K6,

V	<p>ANALYTICAL CHEMISTRY</p> <p>Volumetric analysis – Normality, molarity and molality, primary and secondary standards – principles of volumetric analysis.</p> <p>Extraction – Soxhlet extraction using immiscible solvents. Purification – crystallization, fractional crystallization and sublimation. Distillation – fractional distillation, vacuum distillation and steam distillation.</p> <p>Chromatography – Principles, techniques and applications – R_f value - Column chromatography – Paper chromatography – TLC, Gas chromatography (GC) and high pressure liquid chromatography (HPLC).</p>	12 Hr	CO 5	K1,K2,K3 K5,K6
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TEXT BOOKS

3. Veeraiyan V. Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006. (Both in Tamil and English).
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8. Soni, P. L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
9. Soni, P. L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
10. Lee, J. D. Concise Inorganic chemistry. UK, Black well science (2006).
11. Puri, B. R., Sharma L.R., Kabia K.K. Principles of Inorganic Chemistry (23rd edition) New Delhi, Shoban lal Nagin Chand & co (1993)
12. Puri, B.R, Sharma L.R, Pathania M.S., Principles of physical chemistry, Vishal Publishing Co 2006.
13. Jain, P.C. and others, Engineering Chemistry, Dhanpat Rai publishing company, New Delhi, Edition 2009.
14. Negi, A.S. and Anand, S.C., 2001. A text book of physical chemistry. Taj Press., New Delhi.
8. Gopalan, R., Subramanian, P.S., Rangarajan, K. Analytical Chemistry.

6.3 Allied Chemistry Syllabus for B.Sc., Biotechnology (w.e.f 2022 – 2023)

Title of the Paper	ALLIED CHEMISTRY			
Category of the course	Year	Semester	Credits	Hours
ALLIED	I	II	3	60
Objectives of the course	<ul style="list-style-type: none"> • To understand the fundamental of acids, bases and solutions, thermodynamics and chemical kinetics. • To understand the basic concepts of organic chemistry and industrial chemistry. 			

Syllabus				
Units	Contents	Hours	COs	Cognitive levels
I	<p>STRUCTURE OF ATOMS AND CHEMICAL BONDING</p> <p>Dalton's Atomic theory- Subatomic particles- concepts of atoms and molecules- General electronic configuration of s, p and d block elements – isotopes, isobars and isotones- shapes of atomic orbitals – periodic table- periodic classification- periodicity, valency. Types of bonds – ionic, covalent, coordinate and hydrogen bonding.</p>	10Hr	CO1	K1,K2,K4,K5
II	<p>ACIDS-BASES AND SOLUTIONS</p> <p>Arrhenius concept of acid and bases, proton transfer theory of acid and bases, Lewis concept of acids and bases, concentration of solution, ways of expressing concentrations of solutions –</p>	12Hr	CO2	K1,K2,K4,K5

	per cent by weight, normality, molarity, molality, mole fraction, pH of solution, pH scale, measurement of pH, buffer solutions, mechanism of buffer action of acid buffer and basic buffer.			
III	<p>CHEMICAL KINETICS AND THERMODYNAMICS</p> <p>Rate – factors influencing rate of reactions – order and molecularity – integrated rate expression for first and zero order reactions – Half life period – Pseudo first order reaction, methods to determine order of the reaction– Effect of temperature on rate – concept of activation energy – Arrhenius equation. Catalysis – Enzyme catalysis (derivation of Michaelis Menton equation)</p> <p>Terminology of thermodynamics – Types of systems, Reversible, irreversible, isothermal, adiabatic processes, exothermic and endothermic reactions – Spontaneous processes –First law of thermodynamics –Need for the second law – different statements of second law –</p>	12Hr	CO3	K1,K2,K3,K4
IV	<p>FUNDAMENTALS OF ORGANIC CHEMISTRY</p> <p>Classification of organic compounds – Hybridization in methane, ethylene, acetylene, and benzene. Definition with examples– electrophiles, nucleophiles, carbenes, and free radicals. Types of reactions: substitution, addition, elimination and condensation. (one example each) Electrophilic substitution reaction in benzene (nitration and sulphonation)</p> <p>Optical isomerism - symmetry, elements of symmetry – Cause of optical activity, Optical isomers of tartaric acid, Racemisation, Resolution by salt formation method – Geometric isomerism of maleic and fumaric acids. – Keto-enol tautomerism in acetoacetic ester.</p>	12Hr	CO4	K1,K2,K3,K4,K5

V	<p>INDUSTRIAL CHEMISTRY</p> <p>Hardness of water: temporary and permanent hardness, disadvantages of hard water – Softening of hard water – demineralization process – Zeolite process, and reverse osmosis – Purification of water – for domestic use – use of chlorine, Ozone and UV light. Definitions of pH, TDS and TSS- Definition and Determination of BOD and COD</p> <p>Fuels – Characteristics and Calorific value, Classification, gaseous fuels like water gas, producer gas, liquefied petroleum gas (LPG), gobar gas, compressed natural gas.</p> <p>Fertilizers– Role of NPK fertilizers – manufacture and uses of Urea, Ammonium sulphate, Superphosphate, Triple super phosphate, Potassium nitrate.</p> <p>Polymers – Natural and synthetic polymers, Thermosetting and Thermo plastic polymers - Degradable and Non-degradable polymers. Poly alkenes preparation and uses (PET, PVC and PTFE Only).</p>	14Hr	CO5	K1,K2,K3,K4,K6
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ESSENTIAL BOOKS

1. Veeraiyan, V. Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Vaithyanathan, S. and Others, Textbook of Ancillary Chemistry, Priya Publications, Karur-2. Edition-2006.
3. Jain, P. C. and others, Engineering chemistry, Dhanpat Rai publishing company, New Delhi, Edition 2009.

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2. Soni, P. L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Lee, J. D. Concise Inorganic chemistry. UK, Black well science 2006.
4. Puri, B. R, Sharma, L. R, Pathania, M. S., Principles of physical chemistry, Vishal Publishing Co. 2006.
5. Negi, A.S., and Anand, S.C., A text book of physical chemistry. Taj Press., New Delhi. 2001

6.4 Allied Chemistry Practical (Bio Chemistry)

Title of the Paper	ALLIED CHEMISTRY PRACTICAL (BIO CHEMISTRY)			
Category of the course	Year	Semester	Credits	Hours
ALLIED	I	I & II	4	48
Objectives of the course	<ul style="list-style-type: none"> To develop skill in quantitative analysis To understand the basic concepts of organic compounds and qualitative analysis of organic compounds. 			

Syllabus				
Practical	Contents	Hours	COs	Cognitive levels
I	VOLUMETRIC ANALYSIS <ul style="list-style-type: none"> Estimation of Sodium hydroxide using HCl – standard Sodium Carbonate. Estimation of Hydrochloric acid using NaOH – standard Oxalic acid. Estimation of Ferrous sulphate using KMnO₄ – standard Mohr's salt. Estimation oxalic acid using oxalic acid – standard Ferrous Sulphate. Estimation of Potassium permanganate using oxalic acid – standard Sodium hydroxide. Estimation of Magnesium using EDTA – standard Zinc Sulphate. 	24Hr	CO1	K2, K4

	<ul style="list-style-type: none"> • Estimation of hardness of water using EDTA 			
II	<p>ORGANIC ANALYSIS</p> <p>Detection of Elements (N,S, Halogens) To distinguish between aliphatic and aromatic, saturated and unsaturated compounds. Functional group tests for phenol, acids (mono, di) aromatic primary amine, amide (mono, di), aldehyde & Carbohydrate – Glucose. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test. (Phenol/cresol, cinnamic acid, benzoic acid, phthalic acid, benzamide, urea, glucose, benzaldehyde & aniline).</p>	24 Hr	CO ₂	K ₂ , K ₄
<p>REFERENCE Basic Principles of Practical Chemistry: Venkateswaran, Veerasamy & Kulandaivel, S. Chand &Co</p>				

6.5 Allied Chemistry Practical (Physics)

Title of the Paper	ALLIED CHEMISTRY PRACTICAL (PHYSICS)			
Category of the course	Year	Semester	Credits	Hours
ALLIED	II	III & IV	4	48
Objectives of the course	<ul style="list-style-type: none"> To develop skill in quantitative analysis To understand the basic concepts of organic compounds and qualitative analysis of organic compounds. 			

Syllabus				
Practical	Contents	Hours	COs	Cognitive levels
I	<p>VOLUMETRIC ANALYSIS</p> <ul style="list-style-type: none"> Estimation of Sodium hydroxide using HCl – standard Sodium Carbonate. Estimation of Hydrochloric acid using NaOH – standard Oxalic acid. Estimation of Ferrous sulphate using KMnO₄ – standard Mohr's salt. Estimation oxalic acid using oxalic acid – standard Ferrous Sulphate. Estimation of Potassium permanganate using oxalic acid – standard Sodium hydroxide. Estimation of Magnesium using EDTA – standard Zinc Sulphate. Estimation of hardness of water using EDTA 	24Hr	CO1	K2, K4

II	<p>ORGANIC ANALYSIS</p> <p>Detection of Elements (N,S, Halogens)</p> <p>To distinguish between aliphatic and aromatic, saturated and unsaturated compounds. Functional group tests for phenol, acids (mono, di) aromatic primary amine, amide (mono, di), aldehyde & Carbohydrate – Glucose. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test. (Phenol/cresol, cinnamic acid, benzoic acid, phthalic acid, benzamide, urea, glucose, benzaldehyde & aniline).</p>	24 Hr	CO ₂	K ₂ , K ₄
<p>REFERENCE</p> <p>Basic Principles of Practical Chemistry: Venkateswaran, Veerasamy & Kulandaivel, S. Chand &Co</p>				

6.6 Allied Chemistry Practical (Bio Technology)

Title of the Paper	ALLIED CHEMISTRY PRACTICAL (BIO TECHNOLOGY)			
Category of the course	Year	Semester	Credits	Hours
ALLIED	I	II	2	24
Objectives of the course	<ul style="list-style-type: none"> • To learn the volumetric experiments • To understand the basic concepts of organic compounds 			

Syllabus				
Practical	Contents	Hours	COs	Cognitive levels
I	VOLUMETRIC ANALYSIS <ul style="list-style-type: none"> • Estimation of Sodium hydroxide using HCl – standard Sodium Carbonate. • Estimation of Ferrous sulphate using KMnO₄ – standard Mohr's salt. • Estimation of Potassium permanganate using oxalic acid – standard Sodium hydroxide. • Estimation of hardness of water using EDTA 	12Hr	CO1	K2, K4

II	ORGANIC ANALYSIS Detection of Elements (N,S, Halogens) To distinguish between aliphatic and aromatic, saturated and unsaturated compounds. Functional group tests for phenol, acids, amide & Carbohydrate. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test. (Phenol, benzoic acid, phthalic acid, urea, glucose).	12 Hr	CO2	K2, K4
REFERENCE Basic Principles of Practical Chemistry: Venkateswaran, Veerasamy & Kulandaivel, S. Chand & Co				

7. COURSE OUTCOMES (CO)

7.1 Course Outcomes for B.Sc., Biochemistry

(a) Allied Chemistry - I

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

CO No.	COURSE OUTCOMES
CO-1	Differentiate chemical reactions from nuclear reactions and illustrate different methods of safe disposal of nuclear waste
CO-2	Understand the composition of fuels, prepare the fertilizers, silicones and have an idea about hardness of water and its purification methods.
CO-3	Explain the basic concepts of classification of organic compounds, hybridization, polar effect, tautomerism, optical activity and polymer chemistry.
CO-4	Learn about the knowledge on concepts of thermodynamics.
CO-5	Describe the kinetics of the reaction and various photo-physical processes using Jablonskii diagram, define the laws of photochemistry and explain photosensitization.

(b) Allied Chemistry – II

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

CO No.	Course Outcome
CO1	Enumerate the Postulates of Werner's and Pauling's Theory and apply the same to explain the hybridization of 4 and 6 coordinate complexes and the industrial applications of coordination compounds.
CO2	Summarize the preparation, physical properties and chemical reactions of α -amino acids, classify proteins and distinguish between DNA and RNA
CO3	Define the terms like antibiotics, antipyretics, analgesics, tranquilizers and the causes and treatment of Diabetes, Cancer and AIDS.
CO4	To learn about electrolytes, galvanic cell and corrosion.
CO5	Discuss the Principle of Volumetric analysis, extraction and distillation and various chromatographic techniques.

7.2 Course Outcomes for B.Sc., Physics

(a) Allied Chemistry - I

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

CO No.	COURSE OUTCOMES
CO-1	Differentiate chemical reactions from nuclear reactions and illustrate different methods of safe disposal of nuclear waste
CO-2	Understand the composition of fuels, prepare the fertilizers, silicones and have an idea about hardness of water and its purification methods.
CO-3	Explain the basic concepts of classification of organic compounds, hybridization, polar effect, tautomerism, optical activity and polymer chemistry.
CO-4	Learn about the knowledge on concepts of thermodynamics.
CO-5	Describe the kinetics of the reaction and various photo-physical processes using Jablonskii diagram, define the laws of photochemistry and explain photosensitization.

(b) Allied Chemistry – II

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

CO No.	Course Outcome
CO1	Enumerate the Postulates of Werner's and Pauling's Theory and apply the same to explain the hybridization of 4 and 6 coordinate complexes and the industrial applications of coordination compounds.
CO2	Summarize the preparation, physical properties and chemical reactions of α -amino acids, classify proteins and distinguish between DNA and RNA
CO3	Define the terms like antibiotics, antipyretics, analgesics, tranquilizers and the causes and treatment of Diabetes, Cancer and AIDS.
CO4	To learn about electrolytes, galvanic cell and corrosion.
CO5	Discuss the Principle of Volumetric analysis, extraction and distillation and various chromatographic techniques.

7.3 Course Outcomes for B.Sc., Biotechnology

Allied Chemistry

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

CO No.	COURSE OUTCOMES
CO1	To learn about the periodic classification of elements and formation of different types of bonds.
CO2	To study the concepts of acids, bases, pH and buffers.
CO3	To enable the students to learn about the kinetics of the reaction and basic concepts of thermodynamics.
CO4	To explain the basic concepts of classification of organic compounds, hybridization, polar effect, tautomerism, optical activity and polymer chemistry.
CO5	To learn about hardness of water, purification methods, TDS, TSS, BOD COD, fuels and fertilizers.

7.4 Course Outcomes for Allied Chemistry Practical-B.Sc., Biochemistry

CO 1 : To learn the principle and estimation of volumetric analysis.

CO 2 : To understand the experiment of organic compound and identification of organic compounds.

7.5 Course Outcomes for Allied Chemistry Practical-B.Sc., Physics

CO 1 : To learn the principle and estimation of volumetric analysis.

CO 2 : To understand the experiment of organic compound and identification of organic compounds

7.6 Course Outcomes for Allied Chemistry Practical-B.Sc., Biotechnology

CO 1 : To learn the principle and estimation of volumetric analysis.

CO 2 : To understand the experiment of organic compound and identification of organic compounds

8 PSO – CO Mapping

8.1 PSO – CO Mapping for B.Sc., Biochemistry

(a) Allied Chemistry - I

Subject	Course Outcome	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
Allied Chemistry-I	CO-1	✓			✓	
	CO-2	✓	✓		✓	
	CO-3	✓			✓	
	CO-4	✓		✓	✓	
	CO-5	✓	✓	✓	✓	✓

(b) Allied Chemistry - II

Subject	Course Outcome	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
Allied Chemistry-II	CO-1	✓			✓	
	CO-2	✓	✓		✓	✓
	CO-3	✓		✓	✓	
	CO-4	✓			✓	
	CO-5	✓			✓	

8.2 PSO – CO Mapping for B.Sc., Physics

(a) Allied Chemistry - I

Subject	Course Outcome	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
Allied Chemistry-I	CO-1	✓			✓	
	CO-2	✓	✓		✓	
	CO-3	✓				
	CO-4	✓	✓	✓	✓	
	CO-5	✓	✓	✓	✓	✓

(b) Allied Chemistry - II

Subject	Course Outcome	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
Allied Chemistry-II	CO-1	✓			✓	
	CO-2	✓	✓		✓	✓
	CO-3	✓		✓	✓	
	CO-4	✓			✓	
	CO-5	✓			✓	

8.3 PSO – CO Mapping for B.Sc., Biotechnology

Allied Chemistry

Subject	Course Outcome	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
Allied Chemistry	CO-1	✓			✓	
	CO-2	✓	✓		✓	
	CO-3	✓				
	CO-4	✓	✓	✓	✓	
	CO-5	✓	✓	✓	✓	✓

9. 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;

- The oral and written examinations (Scheduled and surprise tests),
- Closed-book and open-book tests,
- Problem-solving exercises,
- Powerpoint presentations
- Practical assignments and laboratory reports,
- Observation of practical skills,
- Individual and group project reports,
- Efficient delivery using seminar presentations,

10. 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

11. Keywords.

Isotopes, isotones, silicones, Hardness of water, Deionisation, Reverse osmosis, Polymers, tartaric acid, geometrical isomerism, carnot cycle, first and second law of thermodynamics, photochemistry, Jablonski diagram.