



BISHOP HEBER COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 620017
TAMILNADU, INDIA

COURSE OUTCOMES

**DEPARTMENT
OF
CHEMISTRY**



BISHOP HEBER COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 620017
TAMILNADU, INDIA

STRUCTURE OF THE SYLLABUS

Program Name	Course	Course code	Course Name
B.Sc. Chemistry	Core I	U19CH101	General Chemistry– I
B.Sc. Chemistry	Core Practical I	U19CH1P1	Volumetric Analysis and Applied Experiments
B.Sc. Chemistry	Core II	U19CH202	General Chemistry- II
B.Sc. Chemistry	Elective I	U19CH2:P	Applications of Computer in Chemistry
B.Sc. Chemistry	SBEC I	U19CH2S1	Textile Chemistry
B.Sc. Chemistry	Core III	U19CH303	General Chemistry- III
B.Sc. Chemistry	Core Practical II	U19CH3P2	Inorganic Qualitative Analysis
B.Sc. Chemistry	Core IV	U19CH404	Inorganic Chemistry- I
B.Sc. Chemistry	Core Practical III	U19CH4P3	Organic Analysis
B.Sc. Chemistry	Core V	U19CH505	Organic Chemistry- I
B.Sc. Chemistry	Core VI	U19CH506	Physical Chemistry - I
B.Sc. Chemistry	Core Practical IV	U19CH5P4	Gravimetric Analysis, Organic and Inorganic preparation and Determination of Physical Constant
B.Sc. Chemistry	Elective II	U19CH5:2	Biochemistry
B.Sc. Chemistry	Elective II	U19CH5:A	Polymer Chemistry
B.Sc. Chemistry	Elective II	U19CH5:B	Forensic Chemistry
B.Sc. Chemistry	Core Project	U19CH5PJ	Project
B.Sc. Chemistry	SBEC II	U19CH5S2	Pharmaceutical Chemistry
B.Sc. Chemistry	SBEC III	U19CH5S3	Industrial Chemistry
B.Sc. Chemistry	Core VII	U19CH607	Inorganic Chemistry- II
B.Sc. Chemistry	Core VIII	U19CH608	Organic Chemistry- II
B.Sc. Chemistry	Core IX	U19CH609	Physical Chemistry - II
B.Sc. Chemistry	Core Practical V	U19CH6P5	Physical Chemistry Practical
B.Sc. Chemistry	Elective III	U19CH6:3	Analytical Chemistry
B.Sc. Chemistry	Elective III	U19CH6:C	Agricultural Chemistry
B.Sc. Chemistry	Elective III	U19CH6:D	Dairy Chemistry



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CORE COURSE I: GENERAL CHEMISTRY –I

SEMESTER: I
CREDITS:4

CODE: U19CH101
TOTAL HOURS: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Recollect the atomic structure & Concept of Quantization.	K2	I
CO 2	Reason out the periodicity of elements with their properties.	K4	II
CO 3	Predict the shape of molecules based on VBT and VSEPR theories.	K4	III
CO 4	Comprehend the principles and methodology of a systematic and skillful volumetric analysis.	K2	IV
CO 5	Apply the various concentration units for solutions.	K3	V
CO 6	Balance chemical equations.	K3	V

Core Practical - I: VOLUMETRIC ANALYSIS AND APPLIED EXPERIMENTS

Semester: I
Credit:2

Code: U19CH1P1
Total Hrs.: 45

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Apply knowledge of principles of volumetric Analysis estimate a given analyte.	K3
CO 2	Perform a systematic and skillful volumetric analysis	K4
CO 3	Prepare standard solutions with different concentration units	K4
CO 4	Choose appropriate titrimetric method for a given sample.	K5
CO 5	Produce accurate and precise results in a prescribed format	K5
CO 6	Determine the quality of water used for different purposes	K3



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CORE COURSE II: GENERAL CHEMISTRY – II

SEMESTER II
CREDITS:5

CODE: U19CH202
TOTAL HOURS: 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Apply the IUPAC nomenclature name hydrocarbons	K3	I
CO 2	Describe the chemistry of alkanes, cycloalkanes, alkenes, dienes and alkynes	K2	II
CO 3	Describe the chemistry of Compounds of Boron, Nitrogen and Oxygen family	K2	III
CO 4	Apply Gas laws to explain the behaviour of gaseous and liquid states in specific systems	K3	IV
CO 5	Classify colloids their characteristics and applications	K3	V
CO 6	Describe the principles concerning solid state structures	K3	V

SBEC I: TEXTILE CHEMISTRY

Semester: II
Credits:

Code: U19CH2S1
Total Hours: 30

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Describe the types and properties of Fibers	K2	I
CO 2	Outline the manufacturing processes of the cotton and synthetic fibers	K2	II
CO 3	Compare and classify Dyes based on their nature	K2	III
CO 4	Elaborate the bonding interactions of dyes with Fibers	K2	III
CO 5	Apply the principles of the dyeing process	K3	IV
CO 6	Comprehend the entire process of manufacture of clothing	K2	V



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ELECTIVE I- PRACTICAL- APPLICATIONS OF COMPUTER IN CHEMISTRY

Semester : II

Credits: 2

CodeU19CH2:P

Total Hrs : 45

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Draw Chemical structure, reaction pathways and apparatus set up using Chemistry drawing Tools	K3
CO 2	Perform basic quantum chemical calculations using ARGUS LAB	K3
CO 3	Relate the structure with the properties of chemical compounds using Online and offline software	K3
CO 4	Retrieve Physical and Chemical properties using relevant software	K3
CO 5	Convert output & input files required digital formats	K2
CO 6	Visualize the different Molecular orbitals of chemical compounds	K2

Core - III: GENERAL CHEMISTRY – III

SEMESTER: III

CREDITS: 5

CODE: U19CH303

TOTAL HOURS: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Summarize the chemistry of halogens, oxyacids of halogens, the trends in properties and reactivity of the f-block elements and d-block elements and their compounds, alcohols, phenols, aliphatic halogen compounds, benzene and its derivatives.	K4	I-IV
CO 2	Describe the anomalous behavior of fluorine, differences between pseudo-halogens interhalogens and halogens, chemistry of cyanogens, thiocyanogen and Astatine, separation of lanthanides, extraction of actinides and chemistry of aromatic alcohols.	K4	I, II, IV
CO 3	Compare the structural and chemical aspects of haloacids, oxyhalides, interhalogens, ethers, epoxides and mono-, di, and trihydric alcohols.	K5	I, III
CO 4	Explain the role of the concepts - solubility product, common ion effect in group separation.	K4	II
CO 5	Comprehend the structure of benzene and the effect of substituent in benzene ring.	K5	IV
CO 6	Explain the theories of reaction rate, types and Mechanism of adsorption, the concept of catalysis and the factors affecting catalysis.	K5	V



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Core Practical - II: INORGANIC QUALITATIVE ANALYSIS

Semester: III

Code: U19CH3P2

Credits: 2

Total Hours :45

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Recall the basic Principles of Inorganic Qualitative Analysis.	K2
CO 2	Apply the various principles identify the cations and anions systematically.	K3
CO 3	Exhibit analytical skill in identifying a given inorganic mixture using Systematic semi micro method with green approach.	K4
CO 4	Separate the cations in different groups	K3
CO 5	Confirm the cations and anions by Confirmatory tests	K5
CO 6	Present a Scientific report without violating protocols and procedures.	K4

Core Course – IV - INORGANIC CHEMISTRY- I

Semester: IV

Code: U19CH404

Credits: 5

Total Hours: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Predict the hybridization of Coordination compounds and the stable and unstable metal complexes using EAN rule	K5	I
CO 2	Discuss the different types of nucleophilic substitution reactions in Octahedral and Square planar complexes	K4	II
CO 3	Apply different methods calculate dipole moment of molecules	K3	III
CO 4	Explain the magnetic and electrical properties of molecules and complexes	K2	III
CO 5	Summarize the importance of metal carbonyls, metal nitrosyls and metal olefins	K2	IV
CO 6	Illustrate the principles of gravimetric analysis and the types of different binary compounds	K2	V



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CORE PRACTICAL III: ORGANIC ANALYSIS

Semester: IV
Credits: 2

Code: U19CH4P3
Total Hrs. :45

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Apply the knowledge of chemistry behind the qualitative organic analysis	K3
CO 2	Compare different chemical tests to identify organic functional groups	K3
CO 3	Report the results Scientifically	K2
CO 4	Deduce the functional group of different organic compounds based on the inference	K4
CO 5	Confirm the different functional groups by derivatization	K2
CO 6	Justify the results by providing suitable confirmatory tests	K3

CORE COURSE V: ORGANIC CHEMISTRY – I

Semester: V
Credits: 6

Code: U19CH505
Total Hrs.: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Enumerate the dimensionality of molecules and their importance in determining the reactivity.	K4	I
CO 2	Apply the basic concepts of stereochemistry solve the problems related stereochemistry of organic compound.	K3	II
CO 3	Classify the organic compounds in different stereoisomers.	K4	II
CO 4	Categorize different types of reactions of carbonyl compounds based on the reactive species and products.	K4	III
CO 5	Convert mono and di carboxylic acids in other functional groups using relevant reagents.	K4	IV
CO 6	Distinguish the chemistry of different types of nitrogen containing organic compounds	K4	V



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Core Course - VI: PHYSICAL CHEMISTRY – I

Semester: V
Credits: 6

Course Code: U19CH506
Total Hrs: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Predict the feasibility and nature of reactions from the thermodynamic properties like ΔH , ΔG & ΔS values	K5	I
CO 2	Utilize Joule-Thomson effect liquefy gases	K3	I
CO 3	Apply the principle of Carnot cycle all types of heat engines and working fluids	K3	II
CO 4	Compute the absolute entropies of pure substances at temperatures other than 0 K from their heat capacities and heats of transition.	K3	III
CO 5	Predict qualitatively the effect of changing temperature, pressure or concentration on heterogeneous system in equilibrium by means of phase diagram	K5	IV
CO 6	Apply the colligative properties for determining the molecular weight of solutions	K3	V

Elective Course - II: BIOCHEMISTRY

SEMESTER: V
CREDITS: 4

CODE: U19CH5:2
TOTAL HRS : 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain cell structure and functions of cell organelles, Peptides and Proteins	K2	I
CO 2	Comprehend the dependence of body on carbohydrates and lipids for energy generation	K2	II
CO 3	Elucidate the role of enzymes and Hormones in major metabolic pathways	K2	III
CO 4	Discuss the Structure, functions and process of genetic transformation	K2	IV
CO 5	Recognize nitrogen metabolism and the biological role of neurotransmitters	K2	V
CO 6	Describe the cancer cell metabolism	K2	V



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SBEC II: PHARMACEUTICAL CHEMISTRY

Semester: V
Credit: 2

Code: U19CH5S2
Total Hrs.: 30

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the terminology used in pharmaceutical chemistry.	K2	I
CO 2	Relate the structure of heterocyclic drugs derived from pyridine, pyrimidine and quinoline and their therapeutic properties.	K2	I
CO 3	Describe the control mechanism for maintaining normal blood pressure, sugar and cholesterol	K2	II
CO 4	Identify the medicinally important compounds of Al, Fe & As in the market.	K3	III
CO 5	Recognize the various organic diagnostic agents, anti-neoplastic agents narcotic drugs from non-narcotic drugs used as drugs.	K3	IV & V
CO 6	Correlate the structure mechanism and drug action of Antibiotics	K3	IV

SBEC - III INDUSTRIAL CHEMISTRY

Semester: V
Credits: 2

Code: U19CH5S3
Total Hrs.: 30

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Describe the composition and applications of cosmetics	K2	I
CO 2	Classify the polymers and calculate the molecular mass, average molecular mass and weight average molecular mass of polymers	K2	II
CO 3	Discuss the production and general characteristics of industrial products - gaseous fuels, fertilizers, safety matches, fireworks and explosives	K2	III
CO 4	Explain the types, composition, manufacture and uses of glass, cement and ceramics	K2	IV
CO 5	Illustrate the constituents and applications of different protective coatings	K2	V
CO 6	Correlate the basics of industrial processes learnt with the Industry environment and Prepare a Report with suitable data and graphics summarize the industrial processes	K4	V



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**Core Practical - IV: GRAVIMETRY, ORGANIC AND INORGANIC REPARATIONS
AND DETERMINATION OF PHYSICAL CONSTANTS**

Semester: V
Credits: 3

Code: U19CH5P4
Total Hrs.: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Apply the basic principles of Gravimetric Analysis	K3
CO 2	Estimate the accurate quantity of the precipitate by avoiding postand co -precipitation errors	K4
CO 3	Perform single stage organic transformations and Inorganic preparations using standard procedures	K4
CO 4	Produce the maximum quantity of the organic compound as pure crystals	K3
CO 5	Validate the purity of the given compounds by using physical constants	K4
CO 6	Produce a valid and authentic scientific report of the findings in the prescribed format	K4

CORE: PROJECT

Semester: V
Credits: 3

Code: U19CH5PJ
Total Hrs.: 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Identify Simple scientific problems in the real-life situation related Chemical science	K5
CO 2	Search relevant background Literature ensure the credibility of the research problem	K5
CO 3	Develop a smart and achievable strategy solve the problem	K5
CO 4	Develop a feasible, fool-proof and accurate method analyze the problem	K5
CO 5	Critically analyze, corroborate with previously available knowledge and arrive at scientific findings from the observed results	K6
CO 6	Document, Publish and Present the findings scientifically in the relevant forums by taking Cognizance of the ethical & IPR related issues	K5



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Core Course - VII: INORGANIC CHEMISTRY- II

Semester: VI
Credits : 6

Code: U19CH607
Total Hrs. : 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Predict nuclear stability based on basic concepts in nuclear chemistry	K5	I
CO 2	Explain detection separation and application of radio Isotopes.	K5	II
CO 3	Explain semiconducting properties based on theories of metallic bonding	K4	III
CO 4	Describe crystal packing of atoms in metals and their defects	K2	III
CO 5	Distinguish the characteristics of the different types of Silicates	K4	IV
CO 6	Correlate the features of photo physical processes and their applications.	K4	V

Core VIII: ORGANIC CHEMISTRY- II

SEMESTER: VI
CREDITS: 6

Code: U19CH608
Total Hrs.: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Correlate the different organic reactions with the corresponding types of mechanisms.	K4	I
CO 2	Predict the reactivity and orientation of different aromatic substrates towards Electrophiles and Nucleophiles	K5	II
CO 3	Give reason for the formation of intermediates and products in a rearrangement reaction.	K4	III
CO 4	Comprehend the preparation, properties, and structural elucidation of carbohydrates	K3	IV
CO 5	Explain the chemistry of natural products (terpenes and alkaloids)	K2	V
CO 6	Compare the properties and reactivities of five, six membered and fused heterocyclic compounds.	K2	V



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Core IX: PHYSICAL CHEMISTRY – II

Semester: V
Credits: 6

Code: U19CH609
Total Hrs: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the concepts of Electrochemistry and its applications	K4	I
CO 2	Describe the construction of different kinds of electrochemical cells	K2	II
CO 3	Predict the thermodynamic quantities of cell reactions identify the feasibility of reactions	K3	II
CO 4	Illustrate the principle of Molecular Spectroscopy (UV-Vis, IR, Raman, NMR and ESR) and the spectra of selected molecules	K3	III
CO 5	Identify the functional groups and structure of simple molecules using IR spectroscopy	K2	IV
CO 6	Interpret the NMR & ESR spectral data arrive at the structure of molecules	K3	V

Elective Course - III: ANALYTICAL CHEMISTRY

Semester: VI
Credits: 5

Code: U19CH6:3
Total Hrs.: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Adhere first aid procedures and safety measures in Laboratory	K3	I
CO 2	Choose the suitable methodology for purification of compounds.	K3	II
CO 3	Analyze the given set of data statistically identify errors.	K4	II
CO 4	Apply the principles and methods estimate selected organic compounds in a given sample	K3	III
CO 5	Apply the principles and applications of electro analytical and colorimetric methods	K3	IV
CO 6	Apply a suitable chromatographic technique separate various substances present in a mixture. (K3)	K3	V



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Core Practical – V: PHYSICAL CHEMISTRY PRACTICAL

Semester: VI

Code: U19CH6P5

Credits: 3

Total Hrs.: 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Determine the rate constant and order of chemical reactions	K4
CO 2	Determine the molecular weight and transition temperature of unknown compounds using colligative properties	K4
CO 3	Evaluate the critical solution temperature of the given partially miscible liquid systems and the effect of impurities on their critical solution temperature	K5
CO 4	Operate the conductometer, potentiometer and photo colorimeter estimate the strength of unknown solution	K2
CO 5	Evaluate the efficiency of a buffer in resisting changes pH	K5
CO 6	Apply the principles of Chromatography identify the components of the given sample	K3

Allied IV/III : ALLIED CHEMISTRY-I

Semester: III

Code : U19CHY34 /U19CHY33 / U19CHY33

Credits : 3

/U19ESCY3/U19BTC33

Total Hrs. : 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Distinguish the geometry and shape of molecules using VSEPR theory	K4	I
CO 2	Illustrate the mechanism for different basic organic reactions	K3	II
CO 3	Compare the different concepts of acids and bases	K2	III
CO 4	Explain the kinetics of chemical reactions	K3	IV
CO 5	Summarize the applications of catalytic reactions	K2	IV
CO 6	Identify different applications of colloids in day-to-day life	K2	V



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Allied- V :CHEMISTRY FOR PHYSICISTS

Semester: IV
Credits : 4

Course Code : U19CHY45
Total Hrs. : 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the concepts of electrochemistry and its applications	K4	I
CO 2	Apply the principles of solid-state chemistry	K3	II
CO 3	Categorize crystal structures and crystal defects	K4	III
CO 4	Explain the principles of volumetric analysis and types of errors in experimental data	K3	IV
CO 5	Analyze the composition of alloys and mixture based on phase rule	K4	V
CO 6	Identify the significance of chemistry in day-to-day life	K2	V

Allied IV: CHEMISTRY FOR LIFE SCIENCES

(For B.Sc. Bot. / Zoo. / Bio-Tech.)

Semester: IV
Credits : 4

Code: U19CHY44 / U19CHY44/ U19BTC44
Total Hrs. : 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the structure and properties of biomolecules	K4	I
CO 2	Identify the types of water, quality parameters and treatment processes	K3	II
CO 3	Distinguish various kinds of errors in data collection	K2	III
CO 4	Explain the fundamentals of separation and purification techniques	K2	IV
CO 5	Identify the significance of Chemistry in day-to-day life	K2	V
CO 6	Outline the properties and applications of various polymers	K2	V



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Allied – IV: CHEMISTRY FOR ENVIRONMENTALISTS

Semester: IV
Credits: 3

Code: U19ESCY4
Total Hrs.: 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Analyze the constituents of atmosphere and chemistry of various atmospheric reactions	K4	I
CO 2	Apply the concepts of water quality parameters and treatment processes	K3	II
CO 3	Identify the types of errors in experimental data	K2	III
CO 4	Apply the principles of volumetric estimation	K3	IV
CO 5	Explain principles of chromatographic and colorimetric techniques	K2	IV
CO 6	Illustrate the mechanism of organic reactions	K3	V

Allied Chemistry Practical-I/II
VOLUMETRIC AND ORGANIC ANALYSIS
(For B.Sc. Physics / Botany / Zoology / Bio-Tech)

Semester: IV
Credits: 3

Code: U19CHYP1, U19CHYP2, U19BTCP2
Total Hrs.: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO1	Relate the basic principles and types of volumetric analysis.	K2
CO2	Infer the redox reaction concept.	K3
CO3	Estimate the strength of the given solution.	K3
CO4	Apply complexation concept to check water quality	K3
CO5	Identify organic compounds and quantifying.	K5
CO6	Classify the primary standard solutions and to prepare standard solutions in different concentration units.	K3



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Program Name	Course	Course code	Course Name
M.Sc. Chemistry	Core I	P21CH101	Bonding & Structure of Inorganic Compounds
M.Sc. Chemistry	Core II	P21CH102	Concepts in Organic Chemistry
M.Sc. Chemistry	Core III	P21CH103	Chemical Kinetics & Quantum Mechanics
M.Sc. Chemistry	Elective I	P21CH1:A / P21CH1:B / P21CH1:C	Frontier Areas in Chemistry / Green Chemistry/ Forensic Chemistry
M.Sc. Chemistry	Core Practical I	P21CH1P1	Inorganic Quantitative Estimations & Complex Preparation
M.Sc. Chemistry	Core Practical II	P21CH1P2	Organic Synthesis & Separation Techniques
M.Sc. Chemistry	Core IV	P21CH204	Coordination & Organometallic Chemistry
M.Sc. Chemistry	Core V	P21CH205	Reactions & Mechanisms In Organic Chemistry
M.Sc. Chemistry	Core VI	P21CH206	Thermodynamics & Electrochemistry
M.Sc. Chemistry	Core Practical III	P21CH2P3	Inorganic Semimicro Analysis & Colorimetric Estimations
M.Sc. Chemistry	Core Practical IV.	P21CH2P4	Quantitative Analysis of Organic Compounds
M.Sc. Chemistry	Core VII	P21CH307	Organic Spectroscopy
M.Sc. Chemistry	Core VIII	P21CH308	Group Theory & Spectroscopy
M.Sc. Chemistry	Elective -II	P21CH3:2	Bio-Inorganic Chemistry
M.Sc. Chemistry	Core Practical V	P21CH3P5	Physical Chemistry Practical (Non Electrical)
M.Sc. Chemistry	Core Practical VI	P21CH3P6	Physical Chemistry Practical (Electrical)
M.Sc. Chemistry	Core Project	P21CH4PJ	Project Preparatory Course
M.Sc. Chemistry	Core IX	P21CH409	Inorganic Spectroscopy
M.Sc. Chemistry	Elective-III	P21CH4:A / P21CH4:B/ P21CH4:C/ P21CH4:D	Data Analysis & Selected Analytical Techniques / Applications of Chemical Analysis/ Polymer Chemistry/ Agricultural Chemistry
M.Sc. Chemistry	Elective IV	P21CH4:4	Applications of Drug Design & Discovery
M.Sc. Chemistry	Elective V-Practical	P21CH4:P	Computer Aided Molecular Calculations
M.Sc. Chemistry	Core Project	P21CH4PJ	Project



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Core Course - I: BONDING AND STRUCTURE OF INORGANIC COMPOUNDS

Semester : 1

Code: P21CH101

Credits : 5

Total Hrs : 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Predict the reactivity of chemical compounds based on acid-base concepts and HSAB principle	K5	I
CO 2	Assess the role of non-aqueous solvents in chemical reactions	K5	I
CO 3	Distinguish different types of crystal structures and crystal defects	K5	II
CO 4	Explain the nuclear properties, stability and applications of radioactive nuclei	K4	III
CO 5	Predict the structure, geometry, optical and electronic properties of inorganic Compounds using VB, VSEPR, MO and Band theories	K5	IV
CO 6	Classify electron deficient, electron precise and electron rich inorganic compounds based on their structure and bonding	K4	V

Core Course: II - CONCEPTS IN ORGANIC CHEMISTRY

Semester : 1

Code:P21CH102

Credits : 5

Total Hrs :75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Apply the rules of nomenclature to name organic compounds	K3	I
CO 2	Distinguish the reactive intermediates and factors affecting their stability	K4	II
CO 3	Examine the evidences for the kinetics and thermodynamic aspects of reactions	K4	II
CO 4	Apply Huckle's and Craig's rules of aromaticity to benzenoid and non-benzenoid compounds	K3	III
CO 5	Categorize the organic compounds based on stereochemistry	K4	IV
CO 6	Evaluate different methods of reaction mechanism related to molecular rearrangements	K5	V



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Core Course: III-CHEMICAL KINETICS AND QUANTUM MECHANICS
SEMESTER : I **CODE : P21CH103**
CREDITS : 6 **TOTAL HOURS : 90**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Correlate the kinetic properties with thermodynamic properties	K5	I
CO 2	Deduce the rate equation from mechanistic data	K5	I
CO 3	Solve problems by applying the principles of Kinetics and Quantum Mechanics	K5	III
CO 4	Predict the hybridization schemes in molecules through Quantum mechanical approach of MO and VB theories	K5	IV
CO 5	Deduce Wave functions and Energy of simple systems using Approximation methods	K5	IV
CO 6	Analyze the mechanism of heterogeneous catalysis based on the principles of adsorption	K4	V

ELECTIVE I: FRONTIER AREAS IN CHEMISTRY
SEMESTER : I **CODE : P21CH1:A**
CREDITS : 4 **TOTAL HOURS : 60**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Categorize nanomaterials based on structure and properties	K4	I
CO 2	Outline the applications of nanomaterials in various fields	K3	II
CO 3	Summarize the principles and applications of Radiation chemistry in different fields	K4	III
CO 4	Explain the principle of molecular recognition and supramolecular interactions	K4	IV
CO 5	Explain the applications of supramolecules in drug delivery systems and electronic devices	K3	IV
CO 6	Apply the principles of Green Chemistry in chemical processes	K3	V



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ELECTIVE I: GREEN CHEMISTRY

SEMESTER : I
CREDITS : 4

CODE : P21CH1:B
TOTAL HOURS : 60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the principles and significance of green chemistry	K2	I
CO 2	List out the different techniques for Green synthesis	K4	II
CO 3	Examine the different categories of energy-efficient green transformations.	K4	II
CO 4	Contrast the properties of commonly used green solvents	K4	III
CO 5	List out the green processes in industries	K4	IV
CO 6	Explain the source and measurements of energy generated from the feedstock	K5	V

Core Practical : I

INORGANIC QUANTITATIVE ESTIMATIONS AND COMPLEX PREPARATION
(Lab cum Theory)

Semester : I
Credits : 3

Code : P21CH1P1
Total Hrs : 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Formulate a methodology for separation of metal ions from mixtures	K6
CO 2	Estimate metal ions present in a mixture	K5
CO 3	Propose scheme for synthesizing inorganic complexes	K6
CO 4	Interpret UV-Visible spectra of the given inorganic complexes	K5
CO 5	Predict the nature of bonding in coordination compounds using UV-Vis spectra	K5
CO 6	Choose an appropriate method for estimating metal ions in industrial effluents	K5



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Core Practical – II-ORGANIC SYNTHESIS AND SEPARATION TECHNIQUES
(Lab cum Theory)

Semester: I
Credits: 3

Code: P21CH1P2
Total Hrs.: 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Choose appropriate solvent for separation of a binary mixture of organic compounds	K5
CO 2	Test the functional groups present in organic compounds	K5
CO 3	Plan a scheme for the synthesis of organic compounds	K6
CO 4	Infer purity of synthesized compounds by determining their physical constants	K4
CO 5	Separate the organic compounds in a mixture by column chromatographic technique	K4
CO 6	Predict the completion of reaction by thin layer Chromatographic technique	K5

Core Course –IV - COORDINATION AND ORGANOALLIC CHEMISTRY

Semester: II
Credits: 5

Code: P21CH204
Total Hrs: 90

At the end of this course, the students will be able to

CO No	Topic	Level	Unit
CO 1	Evaluate Crystal Field Stabilization Energy of Coordination compounds based on splitting pattern derived from CFT and MOT	K5	I
CO 2	Explain reaction-mechanism and stability constant of coordination compounds	K4	II
CO 3	Categorize various photochemical reactions of coordination compounds	K4	III
CO 4	Explain structure, bonding and stability of organometallic compounds	K5	IV
CO 5	Predict the products obtained from different reactions of organometallic compounds	K5	V
CO 6	Summarize the potential applications of organometallic compounds as industrial Catalysts	K5	V



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Core Course – V:

REACTIONS AND MECHANISMS IN ORGANIC CHEMISTRY

Semester : II

Code : P21CH205

Credits : 5

Total Hours :90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Apply the molecular orbital symmetry to predict the feasibility of pericyclic reactions at different conditions	K3	I
CO 2	Classify different types of Photochemical reactions and their mechanism	K4	II
CO 3	Deduce the organic reaction mechanism based on selectivity of reagent, nature of substrate-structure and reaction condition	K5	III
CO 4	Predict the mechanism of addition reactions with respect to different functional groups and reagents	K5	IV
CO 5	Justify the reactivity of different oxidizing and reducing agents	K5	V
CO 6	Decide the stereochemistry of reaction products with respect to the nature of reagent and condition	K5	V

Core Course -VI: THERMODYNAMICS AND ELECTROCHEMISTRY

Semester: III

Code: P21CH206

Credits: 5

Total Hrs: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Evaluate the macroscopic properties using classical thermodynamics	K5	I
CO 2	Analyze the fundamental concepts of atoms and molecules and their arrangements in different energy levels by statistical approach	K4	II
CO 3	Determine the macroscopic properties based on the translational, vibrational, rotational and electronic partition functions of molecules	K5	III
CO 4	Explain the electrochemical phenomena of various energy storage systems	K4	IV
CO 5	Predict the mean ionic coefficient of different electrolytes and working principle of electrochemical cells and electrodes	K5	IV
CO 6	Justify the electro kinetic phenomena of processes at electrodes	K5	V



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Core Practical - III
INORGANIC SEMIMICRO ANALYSIS & COLORIMETRIC ESTIMATIONS
Semester : II
Credits : 3
Code : P21CH2P3
Total Hrs : 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Classify rare and common metal cations of different groups present in a mixture	K4
CO 2	Develop analytical skills required for identifying and separating cations in a Mixture	K6
CO 3	Choose appropriate reagents for the identification and separation of cations	K5
CO 4	Analyze water and soil samples using the principles of Semimicro Qualitative Analysis	K4
CO 5	Estimate metal ions colourimetrically	K5
CO 6	Test the pollutant concentration in samples by constructing a standard graph applying Beer-Lambert's law	K6

Core Practical – IV - QUANTITATIVE ANALYSIS OF ORGANIC COMPOUNDS
Semester: III
Credits: 3
Code: P21CH2P4
Total Hrs: 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Estimate organic compounds volumetrically	K5
CO 2	Separate the components in organic mixture by paper chromatographic technique	K4
CO 3	Choose the suitable method for purification of organic compounds	K5
CO 4	Recommend appropriate solvents for recrystallization technique	K5
CO 5	Estimate the amount of protein present in milk	K4
CO 6	Compare the saponification value of different oils	K5



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Core Course: VII - ORGANIC SPECTROSCOPY

Semester: III
Credits: 5

Code: P21CH307
Total Hrs: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Analyze the ultraviolet spectra of organic compounds	K4	I
CO 2	Predict the absolute configuration of organic compounds through ORD & CD techniques	K5	I
CO 3	Analyze IR Spectra of various organic compounds pertaining to functional groups and nature of bonding	K4	II
CO 4	Interpret NMR (¹ H, ¹³ C & 2D) spectra for structural elucidation of organic molecules	K5	III
CO 5	Decide the structure of organic molecules based on fragmentation pattern derived from mass spectra	K5	IV
CO 6	Justify the structure of the organic compounds using UV, IR, NMR and Mass spectral data	K5	V

CORE COURSE : VIII - GROUP THEORY & SPECTROSCOPY

SEMESTER : III
CREDITS : 5

CODE : P21CH308
TOTAL HOURS : 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Categorize the molecules based on symmetry elements, symmetry operations and point groups	K4	I
CO 2	Evaluate the selection rules for spectroscopy and hybridization schemes using the concept of molecular symmetry	K5	II
CO 3	Explain the principles involved in different spectroscopic techniques	K5	III
CO 4	Interpret the structure of molecules based on IR and Raman spectroscopy	K5	IV
CO 5	Analyze the importance of electronic spectroscopy and the energy transfer processes	K4	IV
CO 6	Examine the structure of molecules using the principles of NMR & NQR spectroscopy	K4	V



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ELECTIVE COURSE: II - BIO-INORGANIC CHEMISTRY

SEMESTER : III

CODE : P21CH3:2

CREDITS : 4

TOTAL HOURS : 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the role of metal complexes, alkali and alkaline earth metals in living systems	K5	I
CO 2	Illustrate various membrane transport mechanisms in biological systems	K4	II
CO 3	Categorize metalloproteins as redox agents and oxygen carriers based on their structure and functions	K4	III
CO 4	Justify the role of various metalloproteins in photosynthesis	K5	III
CO 5	Summarize the physiological and biochemical functions of minerals and their toxicity	K5	IV
CO 6	Correlate the structure and mode of action of therapeutic drugs	K4	V

Core Practical: V - PHYSICAL CHEMISTRY PRACTICAL (NON ELECTRICAL)
(Lab. Cum Theory)

Semester : III
Credits : 3

Code : P21CH3P5
Total Hrs :90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Determine the Arrhenius parameters from kinetics data	K5
CO 2	Evaluate the influence of ionic strength on rate constant	K5
CO 3	Recommend the optimal conditions to automotive antifreeze using colligative properties	K5
CO 4	Choose specific and selective adsorbents for industrial and environment related problems using Adsorption isotherms	K5
CO 5	Measure qualitative and quantitative parameters of components in drugs, cosmetics, food and beverages, polarimetrically	K5
CO 6	Assess the heat of solution for solute and solvent in a given mixture	K5



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Core Practical: VI- PHYSICAL CHEMISTRY PRACTICAL (Electrical)
Semester : III **Code : P21CH3P6**
Credits : 3 **Total Hrs :90**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Utilize the potentiometer and conductivity meter to estimate the strength of various acids, bases, halides and other salts in the given mixtures	K3
CO 2	Compare the reliability of results for a given experiment by Conductometric and Potentiometric methods	K5
CO 3	Construct different types of electrochemical cells	K6
CO 4	Prioritize the methods of analysis for an experiment in a given set of conditions	K5
CO 5	Analyse the solubility product of the given salt by conductometric and potentiometric methods	K4
CO 6	Demonstrate the kinetics of reactions by Conductometric method	K2

PROJECT PREPARATORY COURSE
Core Project (Theory)

Semester : III **Code: P21CH4PJ**
Credits: **Total Hrs : 15**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Choose an appropriate problem and suitable methodology with respect to the challenges in the field	K6
CO 2	Survey literature sources for adapting alternate or new methodologies	K4
CO 3	Compile project findings for presenting the solution to broader audience	K5
CO 4	Practice ethical and professional values	K5
CO 5	Justify the findings with relevant scientific evidences	K5
CO 6	Propose new, sustainable and innovative solutions for real time applications	K4



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Core Course: IX-INORGANIC SPECTROSCOPY

Semester : IV
Credits: 6

Code : P21CH409
Total Hrs: 90

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Explain the metal-ligand interaction in transition metal complexes through electronic spectra	K5	I
CO 2	Justify the structure and bonding of coordination compounds using IR and Raman Spectroscopy	K5	II
CO 3	Analyze the splitting pattern of NMR signals with respect to different nuclei present in inorganic compounds.	K4	III
CO 4	Analyze the EPR spectra of Inorganic compounds based on the effect of spin-orbit coupling and crystal field effects.	K4	IV
CO 5	Examine the effect of magnetic and quadrupole fields on Mossbauer spectra of simple Molecules.	K4	V
CO 6	Deduce the structure of coordination compounds using data derived from Electronic, IR, Raman, NMR, ESR and Mossbauer spectroscopic techniques.	K5	I - V

Elective Course – III A

DATA ANALYSIS AND SELECTED ANALYTICAL TECHNIQUES

Semester: IV
Credits: 4

Code: P21CH4:A
Total Hours: 75

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Justify different hypothetical tests to confirm the reliability of measured data	K5	I
CO 2	Explain the principle and applications of various electro analytical techniques	K4	II
CO 3	Analyze the Chromatogram of different chromatographic techniques	K4	III
CO 4	Apply the analytical, spectral and microscopic techniques for structure interpretation	K3	IV
CO 5	Determine the Crystal parameters and the crystal structures	K5	V
CO 6	Analyze the structural composition and morphology of molecules	K4	V



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ELECTIVE COURSE:III B - APPLICATION OF CHEMICAL ANALYSIS
SEMESTER : IV **CODE : P21CH4:B**
CREDITS :4 **TOTAL HOURS : 75**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Categorize and analyze pesticides and fertilizers by analytical methods	K4	I
CO 2	Investigate quality of soil	K5	II
CO 3	Estimate the various components present in the coal by Proximate and Ultimate analysis	K5	II
CO 4	Apply the knowledge of electrochemistry in mitigating corrosion	K5	III
CO 5	Estimate the chemical substances in the given sample by Neutron activation analysis and Isotope dilution analysis	K5	IV
CO 6	Explain the various chemical reactions involved in the clinical analysis of blood	K5	V

ELECTIVE COURSE: IV-APPLICATIONS OF DRUG DESIGN & DISCOVERY
SEMESTER : IV **CODE : P21CH4:4**
CREDITS : 4 **TOTAL HOURS : 90**

At the end of this course, the students will be able to

CO No	Course Outcomes	Level	Unit
CO 1	Correlate the pharmacokinetics and pharmacodynamics of processes from Drug to Hit	K4	I
CO 2	Evaluate the different modes of drug - receptor interactions	K5	II
CO 3	Propose a Retro-synthetic strategy for the drug molecule	K6	III
CO 4	Employ the principals involved in simple QM & MM Calculations and QSAR procedures for a given drug molecule (K3)	K3	IV
CO 5	Analyze the Steps involved in a docking Scheme	K4	IV
CO 6	Create and Interconvert Molecular Representations in different electronic formats for further computation and Topological Analysis	K6	V



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**Elective: V - COMPUTER AIDED MOLECULAR CALCULATIONS
(PRACTICAL)**

Semester: IV
Credits: 3

Code: P21CH4:P
Total Hrs :60

At the end of this course, the students will be able to

CO No	Course Outcomes	Level
CO 1	Construct the chemical structure of molecules using computational tools	K6
CO 2	Analyze chemical structures using software such as Mercury and JMOL	K4
CO 3	Interpret the properties of drugs using QSAR study, PDB search, and Regression analysis	K5
CO 4	Determine different chemical quantities (UV spectra, Adsorption and Toxicity value) using computational software such as DruLiTo, Chemdraw and Argus Lab	K5
CO 5	Predict the structure and properties of molecules using appropriate computational tools	K5
CO 6	Inspect the binding efficiency of Pro-drug molecules using docking studies	K4