



SCHOOL OF ENGINEERING AND SCIENCES

B.Sc. (Hons) Chemistry

2022-26 Batch

B. Sc. (Hons) Chemistry

Semester-3							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
AEC	School AEC	Problem Solving Skills	1	0	1	2	60
VAC	School VAC	Co-Curricular Activities	0	0	2	2*	0
VAC	School VAC	Community Service and Social Responsibility	1	0	1	2*	0
SEC	Department/School SEC	Digital Literacy	1	0	1	2	60
CC	Core	Fundamentals of Organic Chemistry	3	0	1	4	120
CC	Core	Inorganic Chemistry II: Chemistry of Elements	3	0	1	4	120
CC	Core	Physical Chemistry II: Chemical thermodynamics and chemical kinetics	3	0	1	4	120
OE/Minor	MC/OE					3	90
Semester Total						19	570
Semester-4							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
AEC	School AEC	Creativity and Critical thinking Skills	1	0	1	2	60
VAC	School VAC	Co-Curricular Activities	0	0	2	2*	0
VAC	School VAC	Community Service and Social Responsibility	2	0	0	2*	0
SEC	Department/School SEC	Leadership for Professionals	2	0	0	2	60
CC	Core	Basic Concepts in Analytical Chemistry	3	1	0	4	120
CC	Core	Inorganic III: Transition Metal & Bioinorganic Chemistry	3	0	1	4	120
CC	Core	Chemistry of Functional groups in Organic Molecules: Structure and Reactivity	3	0	1	4	120
CC	Core	Physical Chemistry III: Chemistry of solutions	3	0	1	4	120
OE/Minor	MC/OE					3	90
Semester Total						23	690

Semester-5							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
VAC	School VAC	Co-Curricular Activities	0	0	2	2*	0
VAC	School VAC	Community Service and Social Responsibility	2	0	0	2*	0
SEC	SEC Elective	Career Skills-1				3	90
CC	Core	Aromatic compounds and Heterocycles	3	0	1	4	120
CC	Core	Physical Chemistry IV: Chemistry at the Interfaces	4	0	0	4	120
CC	Core	Principles of Instrumental Analysis	3	0	1	4	120
CC	Core	The Quantum World: An Introduction to Quantum Chemistry	4	0	0	4	120
OE/Minor	MC/OE					3	90
Semester Total						22	660
Semester-6							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
VAC	School VAC	Co-Curricular Activities	0	0	2	2	60
VAC	School VAC	Community Service and Social Responsibility	2	0	0	2	60
SEC	SEC Elective	Career Skills-2				3	90
CC	Core	Introduction to Modern Organic Synthesis	3	1	0	4	120
CC	Core	Supervised Learning	0	0	4	4	120
CE/SE	Core	Structural Methods and Analysis	3	0	1	4	120
OE/Minor	MC/OE					3	90
Semester Total						22	660
Semester-7							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
CE/SE	Core	Selected Topics in Organic Synthesis	4	0	0	4	120
CE/SE	Core	Chemistry on Computers: Molecular Modelling	4	0	0	4	120
CE/SE	Core	Chemistry in Life and Medicine	4	0	0	4	120
RDIP	Core	Project 1	0	0	4	4	120
OE/Minor	MC/OE	Minor-5				3	90
Semester Total						19	570

Semester-8							
Category	Sub-Category	Course Title	L	T/D	P/Pr	Credits	Learning Hours
RDIP	Core	Project 2 - Thesis	0	0	12	12	360
Semester Total						12	360

Core Electives

1. Structural Methods and Analysis
2. Selected Topics in Organic Synthesis
3. Chemistry on Computers: Molecular Modelling
4. Chemistry in Life and Medicine

Minor Program/Open elective- Chemical Science

1. Principles of Chemistry
2. Fundamentals of Nanoscience
3. Organic Chemistry: Synthesis and Characterization
4. Chemical Thermodynamics
5. Chemistry of Renewable Energy
6. Environmental Chemistry
7. Quantum Chemistry
8. Analytical Techniques in Pharmaceutical Industry

Appendix-I

Syllabus of III & IV Semesters

Semester-III

Problem Solving Skills

Digital Literacy

Structure of a computer; Basics of Operating System; Application software: Office Automation – Creation and usage of word documents, creating Presentations, using spread sheets usage of Google drive, docs, sheets and slides; Online resources: Navigating a website, Search Engines, Bookmarks, Online fraud and scams, Internet Privacy, Creating Blogs, Managing social media, Digi Locker; Best practices for the usage of ICT methods; Video conferencing, best apps for online notetaking; Managing digital identity and reputation, reporting online cheating cases; Cyber security: Discussion of issues such as cyberbullying, phishing scams, and avoiding or detecting malware.

Fundamentals of Organic Chemistry

Electronic structure and bonding, electronic displacement effects, cleavage of bonds, nucleophiles, electrophiles, reactive intermediates, organic acids and bases, aromaticity. Stereochemistry, conformational analysis, interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations, stereoisomerism, molecular chirality, nomenclature. Aliphatic hydrocarbons: structure, preparation, and its reactivity.

Inorganic Chemistry II: Chemistry of Elements

The position, nature, abundance of s-,p- block elements in the periodic table. Electronic configuration, colour, magnetism, and reactivity of s-, p- elements. Diagonal relationship of elements, salicylaldehyde/acetylacetonate complexes of Group1 metals. Alkali metals in liquid ammonia and the properties. Allotropy of C, P and S elements, concept of Crown ethers and cryptates. Structure properties of Boron, Nitrogen, Phosphorus, Sulfur and oxygen compounds. Reactivity of halogens, halogen oxides, interhalogen compounds, pseudohalides and applications. Periodic trends of d- and f- block elements, separation of Lanthanides (ion-exchange) method).

Physical Chemistry II: Chemical thermodynamics and chemical kinetics

Intensive and extensive variables; state and path functions; isolated, closed and open systems, various laws of thermodynamics, concept of entropy, heats of reactions, enthalpy of formation, enthalpy of combustion, Gibbs and Helmholtz energy, free energy change and spontaneity, relation between Joule-Thomson coefficient, Maxwell relations, thermodynamic equation of state, Basic laws of kinetics, order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to reaction of nth order, steady-state approximation in reaction mechanisms, Michaelis-Menten Equation, Arrhenius equation of activation energy, Collision theory of reaction rates.

Semester-IV

Creativity and Critical thinking Skills

Leadership for Professionals

Basic Concepts in Analytical Chemistry

Measurement basics and the importance of analytical chemistry, quantitative and qualitative analysis, criteria for selection of method of analysis, Data handling, errors, precision, laboratory safety, sampling in analysis, and computer aided analysis.

Inorganic III: Transition Metal & Bioinorganic Chemistry

Transition metal compounds, electronic configuration, colour, and magnetism of complex compounds. Werner's theory, Valency bond theory, IUPAC nomenclature, isomerism, and stereochemistry of coordination compounds. Crystal field stabilisation energy for octahedral vs. tetrahedral complexes. Nephelauxetic parameter charge transfer spectra of different types of compounds. Definition, nomenclature, classification of organometallic compounds and its applications in catalysis and organic synthesis. Essential elements of life, role of various metals and trace metals in biological systems. Biological nitrogen fixation, photosynthesis and toxic metals and their effects.

Chemistry of Functional groups in Organic Molecules: Structure and Reactivity

Introduction of functional groups in organic molecules: nomenclature, structure, and electronic properties. Preparation of aliphatic alcohols, ethers, and carbonyl compounds. Acidity of carbonyl compounds, oxidation of alcohols, reduction, and addition reactions of carbonyl compounds. Functional group transformation reactions, selective protection of alcohols and aldehydes. Stereoselective and stereospecific reactions, alkylation reactions.

Physical Chemistry III: Chemistry of solutions

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity, coupling of exoergic and endoergic reactions, equilibrium constants and their quantitative dependence on temperature, pressure and concentration, Le Chatelier principle, ideal and non-ideal solutions, lowering of vapour pressure, Raoult's and Henry's Laws and their applications, colligative properties, strong, moderate and weak electrolytes, ionization of weak acids and bases, pH scale, common ion effect, buffer solution, solubility product of sparingly soluble salts, Gibbs Phase Rule, phase diagram of one, two and three component system.