Fazl Ali College, Mokokchung

Department of Chemistry

Program Outcomes(PO) , Program Specific Outcomes(PSO) and Course Outcomes(CO)

for

UNDERGRADUATE SECTION

Syllabus for Honours (CBCS)

The CBCS Course curriculum is well designed and very promising where the core course would help to enrich the subject knowledge of the students and generic electives make integration among various interdisciplinary courses. The introduction of Skill Enhancement Courses (SEC) and Discipline Specific Courses (DSE) would help to gain more powerful knowledge not only in their core Chemistry subject but also in interrelated multidisciplinary subjects and also helps them to become familiar and expert in handling different chemistry-based software after proper training. In brief the student graduated with this type of curriculum would be able to accumulate the subject knowledge along with necessary skills to suffice their capabilities for academia, entrepreneurship and industry.

Program Outcomes:

PO 1. Students will able to understand basic concept in different field of chemistry.
PO 2. Students will able to solve chemistry related problem with logical conclusion.
PO 3. Find out the green route for chemical reaction for sustainable development.
PO 4. Students will able to get good laboratory practice with proper safety.
PO 5. Students will be able to demonstrate the experimental techniques and methods for chemical analysis, synthesis and important data collection and their interpretation.
PO 6. Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.
PO 7. To prepare the students for a successful career in industry and to motivate them for higher education and take up research as a career.
PO 8. To develop an opportunity to work in interdisciplinary groups.

Program Specific Outcomes:

PSO 1. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
PSO 2. Will become familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer, medicinal and biochemistry
PSO 3. Acquires the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques.
PSO 4. To develop leadership and managerial skills promoting the need for lifelong learning as required for a competent professional.
PSO 5. To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
PSO 6. Identify chemical formulae and solve numerical problems.
PSO 7. Achieve the skills required to succeed in graduate school, professional school and the chemical industry like Cement industries, Agro product, Paint industries, Rubber industries, Petrochemical industries, Food processing industries, Fertilizer industries etc.
PSO 8. Understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life.

Course Outcomes:

Semester	Course Code	Course Outcomes
SEM 1	CC-1	**CO 1.** To learn about the extra nuclear structure of atom and get a basic idea about Quantum Chemistry and its Application. **CO 2.** Gives an idea about s, p, d & f block elements with the Concepts of atomic structure and the properties associated with it. **CO 3.** To get an idea of ionic bond, properties and weak chemical Forces. **CO 4.** To study redox reactions and equations, standard electrode poten-Standard Electrode Potential and its application
	CC-2	**CO 1.** To get some fundamental understanding of the concept of pressure, temperature, average velocity, average energy etc. of gas molecules and able to derive the expressions of those properties using Kinetic Theory of gas. Students will learn the deviation of the properties of real gas from kinetic theory of gas behaviour and construct an equation of state that describes their properties. Students will also get information about the various intermolecular forces present in the system. **CO 2.** To get some ideas about various transport processes such as diffusion and viscosity and their measurements. **CO 3.** Help the students to understand the basic concepts regarding rates of various chemical reactions, measurements of the order and rate of the reactions, dependence of rate constants and hence the rate of the reaction on temperature, catalysts etc. and plausible mechanisms of the reactions. **CO 4.** The laboratory course enables students to determine the viscosity of unknown liquid with respect to water by using instrument like Viscometer, solubility of sparingly soluble salt in water and in presence of electrolyte with common ion and in presence of non electrolyte. They will also study the kinetics of various chemical reactions.
	GE-1	**CO 1.** The students will learn the basic structure of atom. **CO 2.** It gives the basic idea of structure, properties and reactivity of organic molecules and their relationship and an overview about Molecular Orbital Theory (MOT). **CO 3.** To get an idea about the structure and nature of intermediates like carbocations, carboanions, radicals and carbenes. **CO 4.** To get an idea about stereochemistry and aliphatic hydrocarbons like alkanes, alkens, alkynes and their reactions. **CO 5.** The laboratory course helps students to develop laboratory training to use melting point and boiling apparatus

Semester	Course Code	Course Outcomes
SEM 2	**CC-3**	**CO 1.** To get an idea on the basics of organic chemistry. Classification, and nomenclature, hybridization, shapes of molecules. Homolytic and Heterolytic fission types of organic reactions and their mechanism. **CO 2.** To get an idea on the concepts of stereochemistry and optical isomerism. **CO 3.** To get an idea on the chemistry of aliphatic hydrocarbons, Carbon-Carbon sigma bonds, Carbon-Carbon pi bonds, *reactions of* alkenes, reactions of alkynes. cycloalkanes and conformational analysis. **CO 4.** To learn about Hückel's rule, aromatic character of arenes, electrophilic aromatic substitution, Friedel-Craft's alkylation/acylation, directing effects of the groups . **CO 5.** The laboratory course enables students to get basic skill of calibration, purification of organic compounds by crystallization, Determination of m.p, b.p & chromatography.
	CC-4	**CO 1.** It provides an advanced idea on the laws of thermodynamics, Concepts of free energy functions. **CO 2.** Students will learn systems of variable composition. **CO 3.** T**o** get detail idea about the chemical equilibrium in ideal gases Concept of fugacity, Gibbs free energy reaction, equilibrium constants, Quantitative dependence on temperature **CO 4.** To learn about the colligative properties, dilute solutions, Raoult's And Henry's law, freezing point. **CO 5.** To get a fair idea about Determination of heat capacity of a calorimeter, enthalpy of neutralization, enthalpy of ionization,heat capacity of the calorimeter and integral enthalpy, basicity/proticity, enthalpy of hydration of copper sulphate, solubility of benzoic acid.
	GE-2	**CO 1.** To learn about the extra nuclear structure of atom and get a basic idea about Quantum Chemistry and its Application. **CO 2.** To learn about atomic structure, quantum mechanics, CO 3. Chemical bonding viz ionic and covalent, MO approach, LCAO. method CO 4. Fundamentals of organic chemistry: inductive effect, resonance, hyperconjugation, bond cleavage, shapes of molecules, intermediates Shapes of molecules, strengths of organic acids and bases. CO 5. Stereochemistry, with examples like ethane, butance and cyclohexane, Aliphatic hydrocarbons viz, alkanes, alkenes and alkynes.
	CC-5	**CO 1.** To get a knowledge of basic concepts of Acids and Bases,) , Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB Application of HSAB principle **CO 2.** To get idea about chemistry of *s* and *p* Block Elements parameters on composition etc. Hydrides and their classification structure, bonding, preparation, properties and uses.

SEM 3	**CC-6**	**CO 3.** To get idea about noble gases occurrence and uses Clathrates; and preparation, properties and structures clathrates; preparation, properties.
	CC-7	Structures, Molecular shapes of noble gas compounds VSEPR theory. **CO 4.** Types of inorganic polymerssilicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates. **CO 5.** The laboratory course helps students to know the difference *between iodo* / iodimetric titrations **CO 5.** To get idea about Concept of phases, components and degrees of freedom Gibbs Phase Rule Clausius-Clapeyron equation , phase diagram for one component systems.

Semester	Course Code	Course Outcomes
SEM-4		**CO 2. To** learn about Order and molecularity of a reaction, rate laws , kinetics of complex reactions Arrhenius equation; activation energy. CollisiontheoryLindemann mechanism. **CO 3. To** learn about types of catalyst, mechanisms of catalyzed reactions . Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis. **CO 4. To** learn about Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state. **CO 5. To** learn practicals about determination of critical solution temperature and construction of the phase diagram Distribution of acetic/ benzoic acid between water and cyclohexane study the equilibrium reaction kinetics.
	CC-8	**CO 1. To** learn about Werner's theory, valence bond theory Electroneutrality principle and back bonding Crystal field theory Octahedral vs. tetrahedral coordination Jahn-Teller theorem IUPAC nomenclature of coordination compounds, labile and inert complexes. **CO 2. To** learn about Transition Elements, general group trends electronic configuration, colour, variable valency, magnetic and catalytic properties. Stability of various oxidation states. **CO 3. To** learn about transition e lements, general group trends electronic configuration, colour, variable valency, magnetic and catalytic properties. Stability of various oxidation states.Lanthanoids and Actinoids,oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides. **CO 4. To** learn about Transition Elements, general group trends electronic configuration, colour, variable valency, magnetic and catalytic properties. Stability of various oxidation states Lanthanoids and Actinoids, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides Metal ions present in biological systems trace metals.Toxicity of metal ions Use of chelating agents in medicine haemoglobin.

	CC-9	**CO 1. To** learn about preparation and important reactions of nitro and compounds, nitriles and isonitriles. **CO 2. To** learn about reactions of naphthalene phenanthrene and anthracene. **CO 3. To** learn about synthesis, reactions and mechanism of substitution reactions of: furan, pyrrole,pyrimidine, indole, quinoline, isoquinoline, derivatives of furan: Furfural and furoic acid. **CO 4. To** learn about, Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine. Citral,Neral and α-terpineol.
	CC-10	**CO 1. To** learn about Conductivity, equivalent and molar conductivity. **CO 2. To** learn aboutIonic velocities, mobilities transference numbers Applications of conductance measurement. **CO 3. To** learn about Faraday's laws of electrolysis, chemical cells, Electromotive force of a cell,Nernst equation, Standard electrode,potential Application of EMF measurements, determination of activity coefficients and transference numbers. **CO 4. To** learn about basic ideas of electrostatics, Clausius-Mosotti equation, Lorenz-Laurentz equation, dipole moment, diamagnetism, paramagnetism, magnetic susceptibility.
	GE-4	**CO 1. To** learn about Transition Elements (3d series) General group trends, Latimer diagrams Lanthanoids and actinoids. **CO 2. To** learn about Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu drawbacks of VBT. IUPAC system of nomenclature. **CO 3. To** learn about Crystal field effect, octahedral symmetry. Jahn-Teller distortion, Square planar coordination. **CO 4. To** learn about Kinetic Theory of Gases Postulates of Kinetic Theory of Gases. Deviation of real gases from ideal behavior, Maxwell Boltzmann distribution laws. Liquids Surface tension Viscosity. Solids: Forms of solids. Symmetry elements, Laws of Crystallography Defects in crystals The concept of reaction rates: Theories of Reaction Rates.
	SEC-2	**CO 1.** To learn about Introduction to Intellectual Property Historical Perspective, different Types of IP, Importance of protecting IP. Copyrights introduction, how to obtain, differences from patents. Trade Marks How to obtain, Different types of marks – Collective marks, certification marks,service marks, Trade names, etc. Differences from Designs. **CO 2. To** learn about Patents, Geographical Indications, Industrial Designs, Layout design of integrated circuits, Trade Secrets **CO 3.** To learn about, Different International agreements **CO 4. To** learn about IP Infringement issue and enforcement**.**
	CC-11	**CO 1. To** learn about structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine, polynucleotides. Amino acids, Peptides and their classification. **CO 2. To** learn about Introduction, classification and characteristics of

SEM-5		enzymes. Introduction to oils and fats. **CO 3. To** learn about Concept of Energy in Biosystems, introduction to metabolism (catabolism, anabolism). Overview of catabolic pathways of fat and protein. Interrelationship in the metabolic pathways of protein, fat and carbohydrate.Caloric value of food. **CO 4. To** learn about Classification, structure and therapeutic uses of antipyretics: Paracetamol, Analgesics: Ibuprofen, Antimalarials: chloroquine, Antibiotics, chloramphenicol, curcumin, azadirachtin, vitamin C and antacid.
	CC-12	**CO 1. To** learn about Postulates of quantum mechanics, Schrödinger equation quantization of energy levels, Heisenberg Uncertainty Principle simple harmonic oscillator model of vibrational motion: Rigid rotator model of rotation of diatomic molecule, qualitative treatment of hydrogen atom and hydrogen-like ions. Setting up of Schrödinger equation for many-electron atoms (He, Li). Chemical bonding LCAO-MO treatment of H_2^+. **CO 2. To** learn about Interaction of electromagnetic radiation with molecules, Rotation spectroscopy, Vibrational spectroscopy, electronic spectroscopy. NMR and ESR spectroscopy. **CO 3. To** learn about Lambert-Beer's law Laws, of photochemistry, , photosensitised reactions, quenching. **CO 4. To** learn about
	DSE-1	**CO 1. To** learn about Green Chemistry: Goals, Limitations. **CO 2. To** learn about Principles of Green Chemistry and **CO 3. To** learn about Designing a Chemical synthesis **CO 4. To** learn about Examples of Green Synthesis/ Reactions and some real-world cases Future Trends in Green Chemistry.
	DSE-2	**CO 1. To** learn about Industrial Gases: Inorganic Chemicals: **CO 2. To** learn about Preparation of metals and ultrapure metals for semiconductor technology. **CO 3. To** learn about ecosystems. air pollution,water pollution, Industrial waste management **CO 4. To** learn about Sources of energy, nuclear pollution
SEM-6	**CC-13**	**CO 1. To** learn about basic principles involved in analysis of cations and anions and solubility products, commonion effect. **CO 2. To** learn about Definition and classification of organometallic compounds metal carbonyls, Zeise's salt,metal Alkyls, Ferrocene. **CO 3. To** learn aboutSubstitution reactions in square planar complexes, Trans- effect,kinetics of octahedral substitution, Ligand field effects and reaction rates. **CO 4. To** learn about catalysis by organometallic compounds.
	CC-14	**CO 1.** To learn about UV Spectroscopy, IR Spectroscopy, NMR Spectroscopy. Applications of IR, UV and NMR for identification of simple organic molecules. **CO 2. To** learn about Carbohydrates: Monosaccharides, Disaccharides, Polysaccharides. **CO 3. To** learn about Color and constitution; Chemistry of dyeing Synthesis and applications of dye with examples. **CO 4. To** learn about classification

		di-block, tri-block and amphiphilic polymers, polymerization reactions Fabrics, Rubbers, Polymer additives.
	DSE-3	**CO 1. To** learn about Qualitative and quantitative aspects of analysis. **CO 2. To** learn about UV-Visible Spectrometry, basic principles of quantitative analysis, Infrared Spectrometry, Flame Atomic Absorption and Emission Spectrometry. **CO 3. To** learn about Thermal methods of analysis: electroanalytical methods, Separation techniques, Solvent extraction, Mechanism of extraction Technique of extraction Chromatography IC, GLC, GPC,TLC and HPLC. **CO 4. To** learn about Separation Techniques Chromatography:Solvent Extractions: Analysis of soil Ion exchange Spectrophotometry
	DSE-4	**CO 1. To** learn about different schemes of classification of polymers, Polymer nomenclature. **CO 2. To** learn about Criteria for synthetic polymer formation, classification of polymerization processes. **CO 3. To** learn about determination of crystalline melting point and degree of crystallinity, morphology of crystalline polymers. **CO 4. To** learn about Nature and structure of polymers ddetermination of molecular weight of polymers, polymer solution properties of polymers.