TEERTHANKER MAHAVEER UNIVERSITY
Faculty of Engineering

M.Sc. (Chemistry)

Programme Specific Outcome

PSO-1	**:**	Understanding basic information of chemistry including symbols, types of bonds, structure, definitions etc.
PSO-2	**:**	Remembering basic concept of chemistry including classification & properties of elements, functional groups, formation of bonds and configuration of compounds.
PSO-3	**:**	Applying the basic concept of chemistry including classification & properties of elements, functional groups, formation of bonds and configuration of compounds.
PSO-4	**:**	Applying concept of chemistry to bring out the chemical synthesis of compounds, various types of chemical reactions, physicochemical analysis and identification of Compounds.
PSO-5	**:**	Applying positive aptitude to face new challenges in the field of interest.
PSO-6	**:**	Developing new derivatives of the existing compounds and studies their physical and chemical properties and comparative studies for various derivatives of existing compounds and can grow evaluating aptitude.
PSO-7	**:**	Developing new compounds, elemental analysis for percentage determination and establishing the molecular formula and structure by modern techniques like IR, NMR, and Raman Spectroscopy etc.

Course Outcomes

MCH111	**CO-1**	Understanding the Stereochemistry & bonding in inorganic molecules.
	CO-2	Understanding the metal ligand Equilibria, Substitution reaction & electron transfer reaction in coordination chemistry.
	CO-3	Applying concept of electronic transition to study the splitting of electronic energy levels & spectroscopic terms of coordination compounds.
	CO-4	Applying concept of Nucleophilic substitution in synthesizing metal complexes.
	CO-5	Analyzing VSEPR theory in determining the shape of molecules, Molecular orbital theory in constructing MO diagram of triatomic molecules & transition metal complexes.
MCH112	**CO-1**	Understanding the basic concept of chirality, stereo isomerism, conformational isomerism, nucleophilic & free radical

		substitution reaction.
	CO-2	Understanding the addition reaction in C==C and C==O and their stereochemistry involved in various organic reactions.
	CO-3	Applying free radical reaction in explaining various oxidation reactions.
	CO-4	Applying the concept of resonance, inductive and steric effect to explain reaction mechanism in Organic Chemistry.
	CO-5	Analyzing the nucleophilic substitution reaction in aliphatic and aromatic substrates & effect of neighboring group participation by π and σ bonds.
MCH113	**CO-1**	Understanding the concepts of Schrodinger wave equation, variation method, perturbation theory and angular momentum.
	CO-2	Understanding the laws of thermodynamics, rate laws, Phase rule & Fugacity.
	CO-3	Understanding the Chemical dynamics and Partial molar properties of chemical compounds.
	CO-4	Applying the Schrodinger wave equation to explain Eigen value & Eigen Vector for particle in a box, rigid rotor, harmonic oscillator and hydrogen atom.
	CO-5	Analyzing Partial molar properties of partial molar volume, and partial molar heat content.
MAT115	**CO-1**	Understanding basic concepts of research and its methodologies, sampling techniques, meaning of scaling, its classification, important scaling techniques, basic principles of graphical representation
	CO-2	Identifying appropriate research topics using better central tendency and dispersion procedures
	CO-3	Analyzing different research problem and their associated parameters, hypothesis with significance levels and different degree of freedoms, correlation and regression
	CO-4	Evaluating appropriate project proposal (to undertake a project), significance of report writing, layout and precautions for writing research report
	CO-5	Creating, organizing and conducting research (advanced project) in a more appropriate manner with the help of SPSS for data analysis
MCH161	**CO-1**	Detecting of acid and basic radicals including interfering radicals from the given inorganic mixture qualitatively.
	CO-2	Applying the chromatographic techniques for Separation of cations & anions.

	CO-3	Applying the concepts of complexation by synthesize metal complex.
	CO-4	Measuring of molar conductance using conductivity meter.
	CO-5	Measuring of magnetic susceptibility of metal complex by Gouy's Method.
MCH162	**CO-1**	Determining of specific rotation and inversion kinetics of sucrose using polarimeter.
	CO-2	Applying the phase rule, constructing the phase diagram for three component system.
	CO-3	Determining of Rate constant for various chemical reactions.
	CO-4	Validating of Langmuir's and Freundlich adsorption isotherm.
	CO-5	Analyzing the variation of thermo emf with the temperature for the copper-iron thermocouple and characteristics of Si and Ge semiconductor diode.
MCH165	**CO-1**	Describe the usage of computers and why computers are essential components in business and society.
	CO-2	Utilize the Internet Web resources and evaluate on-line e-business syste
	CO-3	Solve common business problems using appropriate Information Technology applications and systems.
	CO-4	Identify categories of programs, system software and applications. Organize and work with files and folders.
	CO-5	Describe various types of networks network standards and communication software.
TMUPA-101	**CO-1**	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount.
	CO-2	Applying the arithmetical concepts in Ratio and Proportion, Mixture and Allegation.
	CO-3	Employing the techniques of Percentage, Ratios and Average in inter related concepts of Time and Work, Time speed and Distance.
	CO-4	Evaluating the different possibilities of various reasoning based problems in series, Direction and Coding-Decoding.
TMUPS-101	**CO-1**	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings
	CO-2	Understanding and analyzing self and devising a strategy for self growth and development.
	CO-3	Adapting a positive mindset conducive for growth through optimism and constructive thinking.
	CO-4	Utilizing time in the most effective manner and avoiding procrastination.
	CO-5	Making appropriate and responsible decisions through various

		techniques like SWOT, Simulation and Decision Tree.
	CO-6	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.
MCH211	**CO-1**	Understanding of bonding, synthesis & structure of transition metal π acid complexes.
	CO-2	Understanding of structure, bonding, electron counting in metal cluster compounds.
	CO-3	Understanding of Origin of magnetic moment & application of magneto chemistry in coordination chemistry.
	CO-4	Understanding & Applying Mossbaeur spectroscopy to study bonding & structure of Iron & Tin compounds.
	CO-5	Applying 4 digit coding (s, y, t, x numbers) to study the bonding & topology of boranes.
MCH212	**CO-1**	Understanding elimination reactions, molecular orbital symmetry of conjugated system, oxidation-reduction in various organic substrates.
	CO-2	Applying elimination reactions, orientation of double bond, elimination versus substitution.
	CO-3	Applying conrotatory and disrotatory motion mechanism of various oxidation and reduction reaction.
	CO-4	Analyzing the effect of various factors in elimination reactions on electrocyclic, cyclo-addition and sigma tropic rearrangements.
	CO-5	Analyzing the effect of photochemical and thermal effect on electrocyclic, cyclo-addition and sigma tropic rearrangements.
MCH213	**CO-1**	Understanding the fundamentals of Chemical kinetics to know the rate andorder of the chemical reactions.
	CO-2	Understanding the reaction rates by different theories.
	CO-3	Understanding the potential energy surface & reaction mechanism.
	CO-4	Understanding the partition function & chemical equilibrium to understand RRK & RRKM theories.
	CO-5	Understanding theories of electrochemical phenomenon.
	CO-6	Understanding the irreversible and reversible electrode processes.
MCH214	**CO-1**	Understanding the fundamentals of unifying principles and natural line width and natural line broadening.
	CO-2	Understanding the basic principles and theory of Microwave Spectroscopy.
	CO-3	Understanding the basic principles and theory of Infrared and Raman Spectroscopy.
	CO-4	Applying the Microwave Spectroscopy to determining the

		structures of organic molecules.
	CO-5	Applying the Infrared and Raman Spectroscopy to determining the structures of organic molecules.
MCH215	**CO-1**	Remembering the introduction of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.
	CO-2	Understanding the classification & properties of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.
	CO-3	Understanding the manufacturing & uses of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.
	CO-4	Analysing the saponification value, acid value and iodine number.
	CO-5	Understanding about oils & fats.
MCH261	**CO-1**	Determining Gravimetric & volumetric estimation of mixture of two metal ions present in the given inorganic mixture.
	CO-2	Determining the molecular composition of ferric salicilate/ironphenanthroline/iron-dipyridyl complex by Job's method of continuous variation.
	CO-3	Determining the Stability constant of FeSCN2+complex.
	CO-4	Determining the pH of a given solution by spectrophotometry using methyl red indicator.
	CO-5	Synthesizing of metal complexes
MCH262	**CO-1**	Understanding mixture of two organic compounds qualitatively.
	CO-2	Applying the mechanism of electrophilic substitution to synthesize few organic compounds
	CO-3	Applying mechanism of oxidation & reduction to synthesize few organic compounds.
	CO-4	Applying mechanism of Cannizzaro reaction & Claisen-Schmidt reaction to synthesize few organic compounds
	CO-5	Applying mechanism of Methylation & Sandmeyer reaction to synthesize few organic compounds
TMUPA-201	**CO-1**	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.
	CO-2	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.
	CO-3	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data
	CO-4	Employing the concept of higher level reasoning in Clocks and Calendars, Set theory and Puzzle Problems.
TMUPS-201	**CO-1**	Communicating effectively in a variety of public and interpersonal settings.

	CO-2	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.
	CO-3	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.
	CO-4	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.
	CO-5	Handling difficult situations with grace, style, and professionalism.
MCH311	**CO-1**	Understanding the principles of UV Spectroscopy.
	CO-2	Understanding in depth principles of NMR Spectroscopy and to interpret the 1H NMR spectra of unknown organic compounds.
	CO-3	Understanding Mass spectrometric techniques, principles, fragmentation patterns for aliphatic compounds, amines, aldehydes, Ketones, esters, amides, nitriles, carboxylic acids ethers, aromatic compounds etc.
	CO-4	Applying the knowledge of Photoelectron spectroscopy, Basic principles of photoacoustic spectroscopy (PAS), chemical and surface applications.
	CO-5	Analyzing the X-ray diffraction techniques with description of the procedure for an X-ray structure analysis.
MSC011	**CO-1**	Remembering the basic concepts of hazards due to noise, waves and rays, chill and hot environment, various kinds of diseases, toxicity of metals, wastes and allocation of functions.
	CO-2	Understanding the standards of hazards, Cause of diseases, technologies, Control and working conditions of labors in various industries.
	CO-3	Understanding the sampling system, control program, and impacts of toxicity and diseases on human health, treatment of wastes and radiations.
	CO-4	Analyzing the level of health hazards, impact of poisonous gases, hazardous and radioactive wastes.
	CO-5	Applying various techniques to control hazardous effects, toxicity, toxic gases, radioactive waste and personal hygiene.
MCH312	**CO-1**	Remembering the composition, classification,& synthesis of polymers.
	CO-2	Understanding the molecular weight determination and identification of functional groups for polymerization.
	CO-3	Applying instrumental methods e.g. Spectroscopic, X-ray diffraction method for Structural studies and other properties of the polymers.

	CO-4	Analyzing the polymers for molding and industrial applications.
	CO-5	Analyzing various products based on physical and chemical properties of polymers.
MCH313	**CO-1**	Understanding the nano technology and its challenges.
	CO-2	Understanding various methods of preparing nano material and their identification.
	CO-3	Applying characterization techniques for the identification of nano particles.
	CO-4	Applying nano materials for energy conservation and storage.
	CO-5	Analyzing materials for the preparation of nano-particles using bacteria, fungi and virus.
MCH314	**CO-1**	Remembering about Coenzyme, Antibiotics, Vitamins, Steroids, Plant Pigments, Terpinoids, Alkaloids & Flavnoids.
	CO-2	Understanding structure, stereochemistry & synthesis of Antibiotics, Vitamins.
	CO-3	Understanding structure, stereochemistry & synthesis of Steroids.
	CO-4	Understanding structure, stereochemistry & synthesis of Plant Pigments, Terpinoids, Alkaloids & Flavnoids.
	CO-5	Applying knowledge of structure & activity relationship new synthesis of natural products can be assigned.
MCH315	**CO-1**	Understanding 18 electrons rule of various organic compounds along with the synthesis.
	CO-2	Applying organometallic compounds for heavy metal, arsenic poisoning as drugs.
	CO-3	Analyzing use of organo metallic compounds as catalyst in various industries.
	CO-4	Analyzing fluxional organo metallic compounds for their specific properties and stereochemistry.
	CO-5	Analyzing the transition metal π- complexes for various organic molecules and nature of bonding.
MCH316	**CO-1**	Understanding the overall process of drug discovery, and the role played by medicinal chemistry in this process.
	CO-2	Understanding relation between structure and physical properties of drugs to their pharmacological activity.
	CO-3	Understanding of concepts such as drug metabolism, bioavailability and pharmacokinetics.
	CO-4	Understanding the role of medicinal chemistry in improving drug metabolism, bioavailability and pharmacokinetics.
	CO-5	Applying the antibiotics, antibacterial, antitubercular, antifungal polyenes, antiviral and Non-steroidal Anti-inflammatory Drugs to treat the different type of diseases.

MCH317	**CO-1**	Understanding different method for orbit coupling and applications of theorem.
	CO-2	Applying Huckel rule for to identify aromaticity of compounds and also stabilization energy models.
	CO-3	Applying various method for the crystal growth techniques and energy Characterization.
	CO-4	Analyzing imperfection in crystals and their properties for industrial use.
	CO-5	Analyzing metal and semi conductors for working potential and their use in industry.
MCH361	**CO-1**	Remembering the estimation of Glucose with the help of Fehling solution.
	CO-2	Understanding the Extraction of caffeine from tea leaves.
	CO-3	Understanding the Saponification and Iodine value of the given oil or fat.
	CO-4	Applying different reaction mechanism in multistep organic synthesis.
	CO-5	Analyzing the pre-recorded UV-Vis, NMR, Mass and IR spectroscopic data of organic compounds.
MCH362	**CO-1**	Determining the strength of an acid by using conductivity meter.
	CO-2	Determining the strength of an acid by using potentiometer.
	CO-3	Determining the dissociation constant of weak electrolyte and verify Ostwald's dilution law.
	CO-4	Determining the equivalent conductance of strong electrolyte at the several concentration and verify Onsager equation.
	CO-5	Verifying the Lambert- Beer's Law using UV-VIS spectrophotometer.
MCH411	**CO-1**	Remembering bio-inorganic chemistry of Alkali and Alkaline Earth Metals, Iron and Copper, Essential and trace elements in biological systems.
	CO-2	Understanding Structure and functions of biological membranes; Rubredoxin and ferredoxins; metalloporphyrin; metalloenzymes and Bio molecules and their functions.
	CO-3	Understanding Structure and Mechanism of hemoglobin, Myoglobin and Cytochrome c.
	CO-4	Understanding Structure and Mechanism of Non-heme proteins: hemerythrin and hemocyanin Nitrogen Fixation, Metal poisoning and their treatment.
	CO-5	Understanding successive steps in the development of Supramolecular Chemistry.
MCH412	**CO-1**	Understanding the fundamentals of photochemistry and depth of reaction mechanisms.

	CO-2	Understanding of miscellaneous Photochemical Reactions.
	CO-3	Understanding organic synthesis and the disconnection approach and functional group interconversions.
	CO-4	Understanding general mechanistic considerations-nature of migration, migratory aptitude, memory effects.
	CO-5	Understanding of miscellaneous rearrangements and Name reactions in Organic Chemistry.
MCH416	**CO-1**	Understanding the chemical composition of Air, water & soil.
	CO-2	Understanding of miscellaneous chemical & Photochemical Reactions occurring in environment.
	CO-3	Understanding general mechanistic considerations-nature of migration, migratory aptitude, memory effects.
	CO-4	Understanding various sources of water, Air & soil pollution and its impact over environment.
	CO-5	Analyzing water quality parameters & its estimation.
MHM420	**CO-1**	Understanding the concepts and skills needed to run a business successfully.
	CO-2	Applying the steps of project formulation and market research.
	CO-3	Analyzing the techno economic feasibility of a project.
	CO-4	Analyzing various growth strategies in small scale industry.
	CO-5	Evaluating breakeven point, working capital requirements, and taxes.
MCH413	**CO-1**	Understanding the presence of essential elements in biological system as well as their mechanism.
	CO-2	Understanding the role of copper and Iron in the synthesis, structure and mechanism of macromolecules.
	CO-3	Applying micronutrients in olants and their biodegradation by micro organisms.
	CO-4	Applying supra molecular molecules in the industrial developments and its mechanism.
	CO-5	Analyzing the nitrogen fixation and metal poising metal and treatment by chelating compounds.
MCH414	**CO-1**	Understanding biological catalysis, properties and identification of active sites by inhibitors.
	CO-2	Understanding the various types of reactions catalysed by enzymes and different types of arrangements.
	CO-3	Applying enzymes models, recognition of asymmetrical molecules for catalysis.
	CO-4	Applying biotechnological techniques for the purification of compounds.
	CO-5	Applying metallo enzymes in the synthesis of biomolecules.
MCH415	**CO-1**	Understanding the biological membranes and consideration of

		standard free energy of various reactions.
	CO-2	Understanding protein structure and ∞ and β bonding among the protein molecules.
	CO-3	Applying thermodynamics in biopolymer solutions and formation of peptides bonds.
	CO-4	Applying bio molecular interactions and various types of physical forces.
	CO-5	Analyzing mechanism of transport through bio membranes and their thermodynamics.
MCH417	**CO-1**	Remembering the systematic nomenclature and general chemical behavior of heterocycles.
	CO-2	Understanding the principles of heterocyclic synthesis involving cyclization and cyclo addition reactions.
	CO-3	Understanding the synthesis and reactions of three & four membered heterocycles, Understanding the synthesis and reactions of six membered heterocycles with one & two or more.
	CO-4	Understanding the role of medicinal applications of Benzo fusedfive membered heterocycles.
MCH461	**CO-1**	Applying the MPN method for count the bacteria.
	CO-2	Analyzing various physical parameters of water like Turbidity, TDS, TSSS & TS.
	CO-3	Analyzing various physical parameters of water like conductivity & pH.
	CO-4	Analyzing various Chemical parameters of water like Total Hardness, Alkalinity & Dissolved oxygen.
	CO-5	Analyzing various Chemical parameters of water like Chemical Oxygen Demand & free Chlorine.