UNDERGRADUATE COURSES

Faculty of Engineering

Department of Chemical Engineering (Ch.E.)

Ch.E.: L-1, T-1
Chem 111: Inorganic Chemistry
3.00 Credit (3 hrs/wk)

Modern concept of atomic structure, Periodic table and its applications, Isotopes and application of radioactive isotopes, Brief discussion on noble gases, Different types of chemical bonds, Hybridization, Molecular structure, Theories of coordination compounds, Application of stability of complex compounds, General treatment of the elements of different groups, Modern theories of acids and bases.

Ch.E.: L-1, T-1
Chem 112: Inorganic Analysis-I
1.50 Credit (3 hrs/wk)

Volumetric analysis: acid-base titration, oxidation-reduction titration and iodometric titration. Gravimetric analysis: estimation of sulfate, separation and estimation of iron and calcium, copper and zinc from their mixtures.

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Ch.E.: L-1, T-2
Chem 131: Physical Chemistry-I
3.00 Credit (3 hrs/wk)

Types of solutions, measures of composition, solubility. Dilute solutions and colligative properties. Colloidal solution, Thermochemistry, Second law of thermodynamics and its applications. Chemical equilibrium of homogeneous and heterogeneous reactions. Thermodynamic treatment of equilibrium constant. Ionization of water and pH scale.

Ch.E.: L-1, T-2
Chem 116: Inorganic Analysis-II
1.50 Credit (3 hrs/wk)

Complexometric titration. Analysis of water and some industrial products.

Ch.E.: L-2, T-1
Chem 235: Physical Chemistry-II
3.00 Credit (3 hrs/wk)

Chemical kinetics, Adsorption and adsorption isotherm, Catalysis. Molecular spectroscopy: rotational, vibrational and electronic spectra of molecules. Phase equilibria, phase rule and its applications. Electrolytic conduction, Electrical properties of solution. Inter ionic attraction theory. Electrochemical cells: Thermodynamics of electrochemical cells, Application of emf measurements. Ionic equilibria, buffer solutions, Henderson equation and its application.

Ch.E.: L-2, T-1
Chem 236: Physical Chemistry Lab.
1.50 Credit (3 hrs/wk)

Partition co-efficient, equilibrium constant by distribution method, Heat of reaction by calorimetry, heat of solution by solubility measurement. Viscosity measurement. Determination of specific rate constant. Measurement of equivalent conductance and solubility of sparingly soluble salt.

Ch.E.: L-2, T-2
Chem 221: Organic Chemistry
3.00 Credit (3 hrs/wk)

The hybridization of carbon atom and covalent bonding. A comprehensive

study of aliphatic hydrocarbons with special reference to nomenclatures, method of preparation, properties and important uses. Types of reactions of aliphatic hydrocarbons and their industrial applications. Structure, nomenclature, preparation, properties, reactions and industrial applications of aliphatic hydrocarbon homologues. Aromatic compounds and aromaticity. Preparation, properties, reactions and industrial applications of benzene and its derivatives. Heterocyclic compounds and their applications. Basic concepts of organic dyes.

Ch.E.: L-2, T-2
Chem 222: Organic Chemistry
1.50 Credit (3 hrs/wk)

Detection of elements in organic compounds, Identification of functional groups, Preparation of different organic compounds, Separation, purification and characterization of organic compounds.

Ch. E.: L-3, T-1
Chem 323(optional): Spectroscopy and stereochemistry
3.00 Credit (3hrs/wk)

A. Spectroscopy

Infrared Spectroscopy (IR): Theory, instrumentation, sample handling interpretation of spectra. Characteristic group absorption, absorption of organic molecules.

Proton Magnetic Resonance Spectrometry (^{1}H NMR): Introduction, instrumentation and sample handling, chemical shift, factors influencing chemical shift, Simple spin coupling, factors influencing coupling constant, Identification of complete ^{1}H NMR spectra.

^{13}C NMR spectroscopy: Introduction, peak assignment, chemical classed and chemical shift, DEPT and COSY.

Ultraviolet and visible spectroscopy: Theory of electronic spectroscopy, instrumentation and sampling, solvent effects, application.

Mass spectroscopy: Basic principles, instrumentation and sampling, isotopes and mass spectra, fragmentation, fragmentation associated with functional groups.

B. Stereochemistry

Chirality, optical isomerism, configuration, conformations of cyclic and acyclic compounds. Geometrical isomerism, fused rings and bridged rings.

Ch. E.: L-3, T-1
Chem 352: Instrumental Methods of Analysis
1.50 Credit (3hrs/wk)

Spectrophotometry, Potentiometric titration, pH-titration, Conductometric titration. Thin layer chromatography.

Department of Materials and Metallurgical Engineering (MME)

MME: L-1, T-1
Chem 107: Selected topics on Inorganic and Physical Chemistry
3.00 Credit (3 hrs/wk)

Modern concepts of atomic structure, advanced concepts of bonds and molecular structure, crystal structure. Modern periodic table, chemistry of transition metals. Properties and uses Properties and uses of noble gases. Acids and bases. Chemistry of solutions. Properties of dilute solutions.

Thermochemistry. Chemical kinetics. Chemical equilibria. Electrochemical cells; Ionization of water and pH. Phase rule and phase diagram. Introduction to organic polymer. Basic covets of dyes, colors and constitution.

MME: L-1, T-1
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3 hrs/wk)

Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu, and Ca volumetrically, complexometric titration, determination of Ca, Mg in water

MME: L-1, T-2
Chem 121: Organic Chemistry (Old: Chem 221)
3.00 Credit (3 hrs/wk)

The hybridization of carbon atom and covalent bonding. A comprehensive study of aliphatic hydrocarbons with special reference to nomenclatures, method of preparation, properties and important uses. Types of reactions of aliphatic hydrocarbons and their industrial applications. Structure, nomenclature, preparation, properties, reactions and industrial applications of aliphatic hydrocarbon homologues. Aromatic compounds and aromaticity. Preparation, properties, reactions and industrial applications of benzene and its derivatives. Heterocyclic compounds and their applications. Basic concepts of organic dyes

MME: L-1, T-2
Chem 122: Organic Chemistry (Old: Chem 222)
1.50 Credit (3 hrs/wk)

Detection of elements in organic compounds. Identification of functional

groups. Preparation of different organic compounds. Separation, purification and characterization of organic compounds.

Faculty of Civil Engineering

Department of Civil Engineering (CE)

CE: L-1, T-1
Chem 103: Chemistry-I
3.00 Credit (3hrs/wk)

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger's wave equation, electronic configurations and properties of atoms. Electronic configurations and properties of molecules: chemical bond, valence bond theory, molecular orbital theory, shape of molecules, bond length, bond energy. Chemistry of halogens, alkali metals, alkaline earth metals, non-metals and heavy metals. Modern concepts of acids and bases. Different types of solutions. Properties of dilute solution. Thermo-chemistry. Electrochemistry: voltaic cells, electrolytic cells. Colloids and colloidal solution. Chemical and ionic equilibria. Chemistry of water; chemistry of water pollution.Chemistry of cements, silicates and limes.

CE: L-1/T-I
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3hrs/wk)

Volumetric analysis: Acidimetry-Alkalimetry. Titrations involving redox reactions: Determination of Fe, Cu, and Ca volumetrically. Determination of Ca and Mg in water.

CE: L-1/T-II
Chem 105 (optional): Chemistry-II
3.00 Credit (3hrs/wk)

Reactions kinetics: rate of chemical reactions; order and molecularity of reactions, different types of rate expressions, methods of determining rate and order, effect of temperature on reaction rate and energy of activation.

Colloid and colloidal solution: Classification, preparation, purification, properties, protective action and application of colloids.
Chemical corrosion: Introduction to chemical corrosion, corrosion of metals and alloys in dry and wet environments, mechanism of corrosion, atmospheric and soil corrosion and their preventive measures.

Chemistry of environmental pollution: Environment and its characteristics, chemistry ofmetal and non-metal pollutants, analytical techniques used in the determination of pollutants, concepts of DO, BOD, COD and threshold odor number, chemistry involved in water treatment plants, quality of industrial waste water.

Polymers: Chemistry of polymerization, different types of polymers and their properties, polymer degradation, elastomers and composite materials.

Paints and varnishes: Introduction to paints and varnishes, pretreatments of the surface, metallic, non-metallic and organic protective coatings, types of paints and their uses.

CE: L-I/ T-II
Chem 106: Inorganic Quantitative Analysis (optional)
(In Support of Chem 105: Prerequisite: Chem 114)
1.50 Credit (3hrs/wk)

Gravimetric Analysis: Determination of sulphate, determination of nickel/zinc. Water Analysis: Acidity and Alkalinity, estimation of chloride, determination of dissolved oxygen in water determination of hardness of water: total hardness of water, estimation of calcium in presence of magnesium; determination of total solid in water.

Department of Water Resources Engineering (WRE)

WRE: L-1, T-1
Chem 115: Chemistry-I (Old: Chem 103)
3.00 Credit (3hrs/wk)

Atomic structure and quantum theory: Bohr's theory, Heisenberg's uncertainty principle, Schrödinger's wave equation, electronic configurations and properties of atoms. Electronic configurations and properties of molecules: chemical bond, valence bond theory, molecular orbital theory, shape of molecules, bond length, bond energy. Chemistry of halogens, alkali metals, alkaline earth metals, non-metals and heavy metals. Modern concepts of acids and bases. Different types of solutions. Properties of dilute solution. Thermo-chemistry. Electrochemistry: voltaic cells, electrolytic cells. Colloids and colloidal solution. Chemical and ionic equilibria. Chemistry of water; chemistry of water pollution.Chemistry of cements, silicates and limes.

WRE: L-1, T-1
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3hrs/wk)

Volumetric analysis: Acidimetry-Alkalimetry. Titrations involving redox reactions: Determination of Fe, Cu, and Ca volumetrically. Determination of Ca and Mg in water.

WRE: L-1, T-2
Chem 105 (optional): Chemistry-II
3.00 Credit (3hrs/wk)

Reactions kinetics: rate of chemical reactions; order and molecularity of reactions, different types of rate expressions, methods of determining rate and order, effect of temperature on reaction rate and energy of activation.

Colloid and colloidal solution: Classification, preparation, purification, properties, protective action and application of colloids.
Chemical corrosion: Introduction to chemical corrosion, corrosion of metals and alloys in dry and wet environments, mechanism of corrosion, atmospheric and soil corrosion and their preventive measures.

Chemistry of environmental pollution: Environment and its characteristics, chemistry ofmetal and non-metal pollutants, analytical techniques used in the determination of pollutants, concepts of DO, BOD, COD and threshold odor number, chemistry involved in water treatment plants, quality of industrial waste water.

Polymers: Chemistry of polymerization, different types of polymers and their properties, polymer degradation, elastomers and composite materials.

Paints and varnishes: Introduction to paints and varnishes, pretreatments of the surface, metallic, non-metallic and organic protective coatings, types of paints and their uses.

WRE: L-I/ T-II
Chem 106 Inorganic Quantitative Analysis (optional):
(In Support of Chem. 105: Prerequisite: Chem. 114)
1.50 Credit (3hrs/wk)

Gravimetric Analysis: Determination of sulphate, determination of nickel/zinc. Water Analysis: Acidity and Alkalinity, estimation of chloride, determination of dissolved oxygen in water determination of hardness of water: total hardness of water, estimation of calcium in presence of magnesium; determination of total solid in water.

Faculty of Mechanical Engineering

Department of Mechanical Engineering (ME)

ME: L-1, T-1
Chem 109: Chemistry-I
3.00 Credit (3hrs/wk)

Modern concepts of atomic structure, advanced concepts of bonds and molecular structure, study of crystal structures, modern periodic table, chemistry of transition metals, properties and uses of noble gases, acids and bases, chemistry of solutions, properties of dilute solutions, chemical equilibrium, thermochemistry, electrochemical cells,ionization of water and pH, chemical kinetics, phase rule and phase diagrams, selected topics on organic chemistry. Introduction to organic polymer, basic concepts of dyes, color and constitution.

ME: L-1, T-1
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3hrs/wk)

Volumetric analysis: Acidimetric and alkalimetric titrations. Titration involving redox reaction (determination ofFe, Cu, and Ca). Complexometric titration (determination of Ca and Mg in water).

ME: L-1, T-2
Chem 141: Chemistry of Engineering Materials
3.00 Credit (3hrs/wk)

Glass: Raw materials, classification, manufacturing processes and application of glasses in chemical industries.

Ceramics: Fundamental of ceramic industry, raw materials, properties, manufacture and classification of ceramic products.

Refractory materials: Raw materials, properties, manufacture and classification of refractories.

Corrosion: Nature, forms and types of corrosion, electrochemical mechanism and prevention of corrosion.

Paints, varnishes and metallic coating: Composition and application of paints, varnishes and metallic coatings, methods used in applying coatings on metal surface.

Carbon: Properties and applications of carbon and graphite, manufacture and applications of non-fabricated industrial carbon.

Polymer: Classification, polymerization, mechanism of polymerization and processing of polymer.

Plastics: Fundamental characteristics, classification, raw materials and manufacture of plastics, some typical examples of plastics and their uses.

Fibres: Types of fibres, raw materials, applications and manufacturing processes of synthetic fibres.

Rubber: Sources of natural rubber, chemical treatment of latex, raw materials, synthetic reactions and properties of synthetic rubber.

Lubricants: Principle of lubrication, sources, properties and refining of lubricants; mechanical and industrial importance of lubrications.

Boiler feed water treatment.

Department of Naval Architecture and Marine Engineering (NAME)

NAME: L-1, T-1
Chem 117: Chemistry-I (Old: Chem 109)
3.00 Credit (3hrs/wk)

Modern concepts of atomic structure, advanced concepts of bonds and molecular structure, study of crystal structures, modern periodic table, chemistry of transition metals, properties and uses of noble gases, acids and bases, chemistry of solutions, properties of dilute solutions, chemical equilibrium, thermochemistry, electrochemical cells,ionization of water and pH, chemical kinetics, phase rule and phase diagrams, selected topics on organic chemistry. Introduction to organic polymer, basic concepts of dyes, color and constitution.

NAME: L-1, T-1
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3hrs/wk)

Volumetric analysis: Acidimetric and alkalimetric titrations. Titration involving redox reaction (determination ofFe, Cu, and Ca). Complexometric titration (determination of Ca and Mg in water).

Department of Industrial and Production Engineering (IPE)

IPE: L-1, T-1
Chem 119: Chemistry-I (Old: Chem 109)
3.00 Credit (3hrs/wk)

Modern concepts of atomic structure, advanced concepts of bonds and molecular structure,
study of crystal structures, modern periodic table, chemistry of transition metals, properties and
uses of noble gases, acids and bases, chemistry of solutions, properties of dilute solutions, chemical equilibrium, thermochemistry, electrochemical cells,ionization of water and pH, chemical kinetics, phase rule and phase diagrams, selected topics on organic chemistry, introduction to organic polymer, basic concepts of dyes, color and constitution.

IPE: L-1, T-1
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3hrs/wk)

Volumetric analysis: Acidimetric and alkalimetric titrations. Titration involving redox reaction (determination of Fe, Cu, and Ca). Complexometric titration (determination of Ca and Mg in water).

IPE: L-1, T-2

Chem 143: Chemistry of Materials
2.00 Credit (2hrs/wk)

Glass: Classification, manufacture and application.

Corrosion, Paints. Varnishes and metallic coating: Composition and

applications of paints, varnishes and metallic coatings, methods used in applying coating on metal surface.

Polymer: Polymerization, classification, mechanism of polymerization and processing of polymer.

Plastic: Fundamental characteristics, classification, raw materials and manufacture of plastics, some typical examples of plastics and their uses.

Fibers: Types of fibers, synthesis and application of synthetic fibers.

Rubber: Source of natural rubber, chemical treatment of latex, synthesis and properties of synthetic rubber.

Lubricants: Chemistry of lubricants, sources, properties, refining, chemical treatment and industrial importance of lubricants.

Faculty of Electrical and Electronic Engineering

Department of Electrical and Electronic Engineering (EEE)

EEE: L-1, T-1
Chem 101: Chemistry-I
3.00 Credit (3 hrs/wk)

Modern concept of atomic structure, Modern periodic table with special reference to group chemistry, Dual nature of electron and modern concept of chemical bond, Properties and molecular structure, Modern concept of acids and bases.

Selected topics of organic chemistry.

Different types of solutions and their compositions, Properties of dilute solution, Phase rule, phase diagram of monocomponent systems,

Thermochemistry, Chemical kinetics, Chemical equilibria, Electric properties of solution and electrochemical cells.

EEE: L-1, T-2
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3 hrs/wk)

Volumetric analysis: acidimetry-alkalimetry, titrations involving redox reaction, determination of Cu, Fe, Ca volumetrically, Complexometric titration, determination of Ca, Mg in water.

Department of Computer Science and Engineering (CSE)

CSE: L-1, T-2
Chem 113: Chemistry-I (Old: Chem 101)
3.00 Credit (3 hrs/wk)

Dual nature of electron and modern concept of chemical bonds, Properties and molecular structure. Solutions and properties of dilute solution. Introduction to colloids and nano chemistry. Phase rule, Phase diagram of monocomponent systems. Thermochemistry; Kirchhof's equation and experimental determination of calorific values of foods and fuels. Chemistry of biodegradable and conductive polymer. Theory of electrolytic conduction, ionic mobility, transport number. Chemistry of proteins, nucleic acids (DNA, RNA), carbohydrates and lipids. Introduction to computational chemistry.

CSE: L-1, T-2
Chem 114: Inorganic Quantitative Analysis
1.50 Credit (3 hrs/wk)

Volumetric analysis: acidimetry-alkalimetry, titrations involving redox reaction, determination of Cu, Fe, Ca volumetrically, Complexometric

titration, determination of Ca, Mg in water.

Dept. of Biomedical Engineering

BME: L-1, T-1
Chem 125: Organic and Inorganic Chemistry
3 Credits (3 hrs/wk)

Structure of the atom: Particle and wave nature of light, light and other form of electromagnetic radiation, atomic spectra, Bohr model, quantum numbers, atomic orbitals; Periodic table: Periodic table, atomic radius, ionization energy, electron affinity, electronegativity. Chemical bonding: Different types of bonding, details of covalent bonding, valence bond theory (VBT), molecular geometry, Valence Shell Electron Pair Repulsion (VSEPR) theory, hybridization of orbital, molecular orbital theory(MOT). Basic concepts of oxidation and reduction reaction. Crystal structure, Ionic solid, Lattice, unit cell, Chemistry of hydrocarbons, Synthetic methods of common organic compounds, Reaction mechanism of typical organic reactions, Structure determination of organic compounds, Basic chemistry of biomolecules.

BME: L-1, T-1
Chem 126: Organic and Inorganic Analysis Sessional
1.5 Credits (3 hrs/wk)

Experiments based on Chem 125

BME: L-1, T-2
Chem 127: Physical Chemistry
3 Credits (3 hrs/wk)

General concepts: Stoichiometry, properties of gas, liquid and solid, gas laws; Solution: Types of solution, properties of solution, Raoults' law, colligative properties. Electrochemistry: Conductance and electrical

properties of solution, electrolytic cell, voltaic cell, commercial batteries, Fuel-cell. Chemical Kinetics: Rate law, rate constant, order, molecularity, first order and second order reaction, Arrhenius equation, theories of reaction rate. Thermochemistry and basic thermodynamics. Equilibria: Phase equilibria, chemical equilibria, acid-base equilibria, ionic equilibria.

BME: L-1, T-2
Chem 128: Physical Chemistry Sessional
1.5 Credits (3 hrs/wk)

Experiments based on Chem 127

Faculty of Architecture and Planning

Department of Urban and Regional Planning (URP)

URP: L-1; T-2
Chem 123: Basic Environmental Chemistry (Old: Chem 207)
3.00 Credit (3 hrs/wk)

Introduction to environmental science and its scope. Radioactivity and radioactive particles, atomic structure. The periodic table, chemical bonds. Acids,bases and environmental impact of pH. Concentration of solutions and estimation of pollutants. Organic compounds (proteins, carbohydrates, oils, PCBs, aldehydes, hydrocarbons, pesticides as organic pollutants), organic families and functional groups. Introduction to polymers and its environmental impact.Environment: environmental segments, lithosphere, hydrosphere, biosphere and atmosphere. Composition of atmosphere, chemical species and particulates present in earth. Industrial hazards, air and water pollutants. Sources and different kinds of pollutants. Toxicity of

pollutants. Discussion on the properties of water and waste water. Characteristics of waste water, concepts and measurement of DO, BOD, COD, etc. Transformation processes of pollutants.