Department of Chemistry
Bangladesh University of Engineering and Technology (BUET)

Undergraduate Courses Offered to Different Engineering Programs

Faculty of Engineering

Department of Chemical Engineering (Ch.E.)

Ch.E.: L-1, T-1 (New)
Chem 111: Inorganic Chemistry **3.00 Credit (3 hrs/wk)**
Modern concept of atomic structure and the periodic table of elements: Molecular structure and advanced theories of chemical bonding; Modern theories of acids and bases; Donor-acceptor chemistry. Coordination chemistry: Theories of coordination compounds; Application of stabilities of complex compounds. Introduction to organometallic and bioinorganic chemistry. Diffraction methods and microscopy in inorganic chemistry

Ch.E.: L-1, T-1
Chem 112: Inorganic Analysis-I (New) **1.50 Credit (3 hrs/wk)**
Volumetric analysis: Acid-base titration; Oxidation-reduction titration and iodometric titration; Precipitation titration. Gravimetric analysis: Estimation of sulfate and zinc; Separation and estimation of iron and calcium, copper and zinc from their mixtures

Ch.E.: L-1, T-2
Chem 131: Physical Chemistry-I **3.00 Credit (3 hrs/wk)**
Solution: Properties of solutions, Raoult's law and measures of composition, solubility and solubility diagram, Distribution law and its applications, Dilute solution and Colligative properties, Introduction to nano chemistry.
Thermodynamics: enthalpy, activity, entropy, free energy, spontaneity of chemical reactions, Thermodynamic treatment of equilibrium constant, Thermo chemistry, Adsorption, Catalysis, Colloids.

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 (1H NMR): Introduction, instrumentation and sample handling, chemical shift, factors influencing chemical shift, Simple spin coupling, factors influencing coupling constant, Identification of complete 1H NMR spectra. 13C 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-2

Chem 133: Physical Chemistry **3.00 Credit (3 hrs/wk)**

Solutions: Types of solution, measure of compositions, solubility. Dilute solutions and colligative properties. Surface chemistry" Adsorption isotherms. Colloids: sol, gel and emulsion. First law of thermodynamics, thermochemistry, second law of thermodynamics, free energy and spontaneity of chemical reactions, chemical equilibrium of homogeneous and heterogeneous reactions, thermodynamic treatment of equilibrium constant. Electrochemistry, electrical properties of solutions, electrochemical cells, ionic equilibria.

MME: L-1, T-2

Chem 135: Inorganic Chemistry **3.00 Credit (3 hrs/wk)**

Modern concepts of atomic structure, isotopes and application of radioactive isotopes. Periodic table and its applications, general treatment of the elements in different groups: main group elements, transition metals and noble gases. Different types of chemical bonds, molecular geometry, modern concept of bonding: valance bond theory and molecular orbital theory. Modern theories of acids and bases. Chemistry of coordination compounds: Introduction to coordination chemistry, Crystal Field Theory (CFT) and Ligand Field Theory (LFT) for metal complexes, geometries of metal complexes, thermodynamic and kinetic aspects of metal complexes.

MME: L-1, T-2: Chem-136
Quantitative Inorganic Analysis **(Credit: 3 hours / week)**.
Standardization of HCl with Na_2CO_3, Standardization of sodium thiosulfate with standard potassium dichromate, Estimation of copper contained in a supplied solution by iodometry, Determination of ferrous ion in a solution by standard potassium permanganate,

Conductometric titration of a mixture of strong acid and weak base with sodium hydroxide,
Determination of Equilibrium Constant by Distribution Method
Preparation of potash alum from scrap aluminum or can

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
Chem145: Chemistry I **3 credits (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. Different types of solutions and their compositions, Theories and Properties of dilute solution, Phase rule, phase diagram of monocomponent systems, Thermochemistry, Chemical kinetics, Chemical equilibria, Electric properties of solution and electrochemical cells, Buffer, Colloid, Distribution law.

BME: L-1, T-1
Chem146: Inorganic and Physical Chemistry Sessional 1.5 credits (3 hrs/wk)
Experiments based on Chem 146. (Determination of equilibrium constant, Kc, Cu^{2+} estimation, Fe^{2+} estimation, KD determination, determination of conc. of HCl by Na_2CO_3, Spectroscopic analysis of Fe^{2+})

BME: L-1, T-2
Chem147:Organic Chemistry 3 credits (3 hrs/wk)

Hydrocarbons and cyclic hydrocarbons and their derivatives: nomenclature, structure, conformational analysis, and reaction mechanism of Alkanes, Alkenes, Dienes and Alkynes. Substitution, elimination reactions, and their competitiveness on Alkyl Halide. Nomenclature, reaction mechanism, and acid base properties of Alcohol, Ether, Epoxide, and Amine. Reaction mechanism of class I (Ester, Carboxylic Acid, Amides) and class II (Aldehydes, and Ketones), carbonyl compounds; Stereochemistry: cis-trans (E, Z) isomerism, chirality, nomenclature of enantiomers, Fischer projection and biological selectivity, diastereomers and meso compounds, racemic mixture; Aromatic: aromaticity, nomenclature of aromatic compounds, and reaction mechanism of Benzenes and substituted Benzenes, Spectroscopy: IR Spectroscopy, NMR Spectroscopy (^1H and ^{13}C) spectroscopy and their application.

BME: L-1, T-2
Chem148: Organic Chemistry Sessional 1.5 credits (3 hrs/wk)

Synthesis of organic compound and its purification, identification by TLC, Elemental analysis by Lassaigne test, Functional group test, Analysis of spectra (IR, NMR) of synthesized compound

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