CHEMISTRY (CH) COURSES

CH 113 CHEMISTRY FOR LIFE SCIENCES STUDENTS 3 UNITS

Objectives:

By the end of the course the students are expected to be able to:

Apply fundamental chemical principles to solve problems related to Life Sciences.

Content:

General Chemistry: Stoichiometry and mole concept. Atomic structure and chemical bonding. Ionic equilibria including pH and buffer solutions, acid-base titration and solubility equilibria. Nuclear radiation and its effects on matter. Introduction to colloidal systems. Practicals based on the above topics.

Fundamentals of Organic Chemistry: Principles of chemical reactivity. Important functional groups in organic molecules. Introduction to stereochemistry. Carbohydrates, lipids, protein and nucleic acids. Enzymes. Bioenergetics. Practicals based on the above topics.

Delivery: 40 lectures hours and 6 sessions of 3-hours practicals.

Assessment: Tests: 25%, Practicals: 15%, Final Examination 60%.

Textbooks:

Theodore L. Brown and H. Eugune LeMay Jr. Chemistry: The Central Science, Prentice-Hall, 7th Ed. 1997.

McMurry, J.; Castallion, M. and Ballantine, D., Fundamentals of General, Organic, and Biological Chemistry, 5th Ed. 2006.

References

Petrucci, R.H. General Chemistry - Principles and Modern Applications 7th ed. Prentice-Hall, 1997.

Zumdahl, S.S. Chemical Principles 4th ed. Heath & Company, 2002.

CH 117 ORGANIC CHEMISTRY I 3 UNITS

Objectives:

By the end of the course the students are expected to be able to:

Explain bonding in organic compounds.

Explain functional group chemistry.

Content:

Main features of carbon compounds, structure and physical properties of carbon compounds, reaction involving covalent bonds. Detailed study of the following classes of organic compounds: Alkanes, alkenes alkynes, benzene, organic halides, alcohols, phenols, ethers, aldehydes, ketones, amines, carboxylic acids and their functional derivatives.

Delivery:45 Lecture hours and 15 Tutorial hours.

Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:

Morrison and Boyd, Organic Chemistry. 6th edition. Prentice Hall, 1992.

J. C. Mcmurry, Organic Chemistry, 6th ed. Brooks/Cole Publishing Co., Belmont, 2003.

CH 118 BASIC ANALYTICAL AND PHYSICAL CHEMISTRY 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
Explain the experimentally measured properties and behaviour of matter on molecular terms.
Describe the concepts of chemical kinetics and electrochemistry
Describe basic analytical techniques and identify major steps in a chemical analysis
Perform basic statistical analysis of data
Identify qualitatively and quantitatively the products of basic chemical reactions.

Content:
Mole concept. Nomenclature of inorganic substances. Stoichiometry. Properties of gases, liquids and solids. Properties of solutions. Chemical equilibrium. Introduction to: (a) chemical kinetics (b) Electrochemistry. Evaluation of analytical data. Majors steps in a typical quantitative analysis. Equilibria: Chemical equilibria; ionic equilibria, pH and buffer solutions. Solubility and solubility product. Precipitation, complex formation and separation methods. Quantitative analysis: Gravimetric analysis. Titrimetric methods: Acid-base, precipitation, complexometric, redox and potentiometric titrations.

Delivery: 45 Lecture hours and 15 Tutorial hours.
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
Zumdahl, S.S. Chemical Principles 4nd ed. Heath & Company, 2002.
Chang Raymond, Chemistry, 8th Ed. 2005
Skoog, West and Holler, Fundamentals of Analytical Chemistry, 7th ed. Saunders College Publishing, 1996.

Reference
Petrucci, R.H. General Chemistry - Principles and Modern Applications 7th ed. Prentice-Hall, 1997.

CH 121 CHEMISTRY PRACTICALS I **2 UNITS**

Objectives:
By the end of the course the students are expected to be able to:
apply the theoretical principles of chemistry as given in the lectures in carrying out related experiments.

Course outline:
A set of experiments based on the following topics: Common laboratory techniques, Gravimetric analysis including determination of water of hydration. Properties of acids, bases and salts in aqueous solution. Precipitation reactions in chemical analysis. Complexes. Complexometry and redox titrations. Properties of gases. Potentiometric acid-base titrations. Error analysis, Relationship between structure and solubilities of organic compounds, purification by recrystallization, the chemistry of functional groups.

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment: 100% Laboratory reports.

Textbooks:
Departmental Laboratory Manuals.

Practicals in Physical Chemistry. T. Forland, G. Ndaalio and K. S. Forland. University of Dar es Salaam. 1980.

CH 122 CHEMISTRY PRACTICALS II 2 UNITS

Objectives:

By the end of the course the students are expected to be able to:
apply the theoretical principles of chemistry as given in the lectures in carrying out related experiments.

Course outline:

A set of experiments based on the following topics: calorimetry, equilibria between organic and aqueous phases. Simple reaction kinetics, error analysis II, Simple organic reactions, identification of unknown compounds. separation by thin layer and column chromatography. Precipitation titration; pH and solubility.

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment: 100% Laboratory reports.

Textbooks:

Departmental Laboratory Manuals.
Practicals in Physical Chemistry. T. Forland, G. Ndaalio and K. S. Forland. University of Dar es Salaam. 1980.

CH 172 CHEMICAL SEPARATION 3 UNITS

Objectives

By the end of the course the students are expected to be able to:
Describe each of separation methods,
Explain how modern separation methods may be applied to separate mixtures
Do quantitative calculations related to the separation of mixtures.

Content:

Sedimentation and Centrifugation: Classes of centrifuges and their applications (low speed, high speed, ultra), Differential centrifugation, Density gradient centrifugation, Rate zonal (size) separation, isopycnic separation, the rotor categories, pelleting efficiency and K-factor, the sedimentation coefficient or S-value. Crystallization: nucleation and factors affecting rate of crystallisation. Distillation: Simple distillation and principles of fractional distillation. Extraction: principles of extraction, equilibrium and phase compositions, Precipitation: solubility and solubility product, fractional precipitation, factors affecting solubilities (ionic strength, common ion effect, complex formation, particle size). Filtration and membrane separation, classification of membranes, permeation and diffusion, diffusion coefficient, osmosis and reverse osmosis, Donnan effect and Knudsen flow, mechanism of membrane separation, pervaporation, temperature and pressure effects on pervaporation. Ultrafiltration, dialysis and ion selective membranes. Chromatography**.** Electrophoresis: disc electrophoresis, capillary electrophoresis, gel electrophoresis (SDS-PAGE). Quantitative calculations related to these techniques.

Delivery: 45 lecture hours and 15 Tutorial hours .
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Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
C. E. Meloan. Chemical Separations: Principles, Techniques and Experiments. J. Wiley & Sons Inc. London, 1999.
2. R. Noble and P. Terry. Principles of Chemical Separations with Environmental Applications. Cambridge University Press, 2003.

CH 173 INTRODUCTION TO ELECTRONIC STRUCTURE AND SPECTROSCOPY 3 UNITS

Objectives
By the end of the course the students are expected to be able to:
Explain the structure of atoms and molecules, and
Describe how atoms and molecules can be investigated by spectroscopy.

Content:
Electrons in atoms, the shape and energy of s, p and d atomic orbitals. Electronic configurations of atoms, the periodic table and periodic trends. Ionization energy, electron affinity and Hund's rule. Isotopes.
Electrons in molecules. Types of bonds: metallic, ionic, polar, covalent and hydrogen bonds, bond strength. Valence Shell Electron Pair Repulsion Theory. Molecular Orbital theory, bonding and antibonding orbitals, first and second row homonuclear diatomics, hybrid orbitals.
Overview of the electromagnetic spectrum and illustration of the basic information derivable from different spectroscopic techniques. Absorption and emission spectra, with particular emphasis on IR, UV and ^{1}H NMR. spectroscopy of simple molecules.

Delivery: 45 lecture hours and 15 Tutorial hours .

Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
1. C Lawrence, A Rodger and R Compton, Foundations of Physical Chemistry, OUP, 1996.
Pavia, D.L., Lampman G.M. and kriz, G. Introduction to spectroscopy. 2nd Ed. 1996

CH 191 THEORETICAL METHODS FOR CHEMISTS 2 UNITS

Objectives:
By the end of the course the students are expected to be able to:
Apply basic theoretical tools to understand various courses in chemistry, including chemical thermodynamics, chemometrics, group theory etc., and
Use theoretical tools in chemistry to solve various chemical problems.

Content:
SI Units and dimensional analysis. The treatment of experimental data focussing on error analysis, error propagation, and the t-test. Comparison of data with theory including linearization of equations, least squares regression and graphical methods. Properties of matrices and their use in solving simultaneous equations in chemistry. Review of basic calculus: the physical meaning of infinitesimal (d) and finite changes (Δ), and the setting up and solving of common first and second order differential equations in chemistry. Locating and characterization of stationary points. Eigenvalue problems in Chemistry and the meaning of eigenvalues, eigenfunctions and eigenvectors. Complex numbers and their role in describing the atomic orbitals.

Delivery: 30 lecture hours and 15 Tutorial hours .

Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
Lipschutz, S. Theory and Problems of Linear Algebra. McGraw Hill, NY, 1974.
Spiegel, M. R. Theory and Problems of Complex Variables, McGraw Hill, NY, 1974.

CH 201 CHEMICAL THERMODYNAMICS 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
Describe concepts applied in chemical thermodynamics.
Apply thermodynamic principles to solve practical problems

Content:
Energy and the first law of thermodynamics. Entropy and the second and the third law of thermodynamics. Free energy and chemical equilibria. Thermodynamic properties of open systems: Thermodynamic treatment of solutions. Phase equilibria and phase diagrams.

Delivery: 45 lecture hours and 15 Tutorial hours .
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
K.S. Forland, and T. Forland, Chemical Thermodynamics. University of Dar es Salaam. 1991.
G. M. Barrow, Physical Chemistry. 5th ed. McGraw-Hill, 2004.

Reference
P. W. Atkins, Physical Chemistry. 7th ed. ELBS/Oxford Univ. press, 2002

CH 219 SYSTEMATIC INORGANIC CHEMISTRY 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
Describe the periodic trends of the elements in the periodic table
Describe the properties of compounds formed by elements in the groups
Compare the properties of compounds formed by different groups
Describe fundamental properties of transition elements

Content:
Periodic properties of elements. The representative elements: Groups I -VII and O. Group characteristics and comparative study of the groups. Introduction to transition metal chemistry. Introduction to bioinorganic chemistry.

Delivery: 45 lecture hours and 15 Tutorial hours .
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
Cotton and Wilkinson, Advanced Inorganic Chemistry by 4th ed., J. Wiley & Sons, 1980.
J.E. Huheey, Inorganic Chemistry: Principles, Structure and Reactivity. Harper & Row, London.

CH 240: PHYSICAL CHEMISTRY 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
Describe concepts applied in chemical thermodynamics.
Explain the experimentally measured properties and behavior of matter on molecular terms.
Describe the concepts of chemical kinetics and electrochemistry

Delivery: 45 lecture hours and 15 Tutorial hours

Content:
The mole concept. Properties of gases, liquids and solids. Basic concepts in thermodynamics: mathematical tools, laws of thermodynamics, thermochemistry, colligative properties, homogeneous mixtures, phase equilibria, chemical and ionic equilibria. Introduction to chemical kinetics and catalysis. Introduction to electrochemistry.

Textbooks:
Barrow, G.M., Physical Chemistry, 5th Edition, McGraw Hill, 1998
Foerland, T. and Foerland, K. S., Thermodynamics, John Willey and Sons, 1990
References:
1.Levine I.N, Physical Chemistry, McGraw Hill, 1995
2.Mortimer, R.G., Physical Chemistry, Harcourt Publishers Ltd., 2000

CH 241 CHEMISTRY PRACTICALS III 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
apply the theoretical principles of chemistry as given in the lectures in carrying out related experiments.

Content:
A set of experiments based on the following topics: Synthesis, separation and identification of components of mixtures of organic compounds and natural products. Preparative inorganic chemistry: Preparation of complexes and study of their chemical properties. Qualitative inorganic analysis. Liquid properties: Partial molal volumes, liquid vapour equilibrium, boiling point composition diagram for binary solutions. Potentiometric titration of complex ions and determination of equilibrium constants.

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment: 100% Laboratory reports.

Textbooks:
Departmental Laboratory Manuals.
Practicals in Physical Chemistry. T. Forland, G. Ndaalio and K. S. Forland. University of Dar es Salaam. 1980

CH 243 ORGANIC CHEMISTRY II 3 UNITS
Objective:
By the end of the course the students are expected to be able to:
Explain terms and concepts applied in stereochemistry.
Describe aromaticity and related concepts.
Describe mechanisms involved in organic reactions.

Content:
Stereochemistry, alicyclic chemistry, reaction mechanisms, electrophilic and nucleophilic substitutions, carbocation rearrangements, elimination and addition reactions, carbanions, oxidation and reduction reactions, aromaticity and aromatic compounds, aromatic substitutions, free radicals, carbenes, nitrenes.

Delivery: 45 lecture hours and 15 Tutorial hours .

Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
Solomon and Fryhale, Organic chemistry, 8th Ed. John Wiley & Son Inc. 2004.
Clayden, Greeves, Warren & Wothen, Organic Chemistry, Oxford University Press, 2001.
Reference
Morrison and Boyd, Organic Chemistry, 5th ed. Allyn and Bacon, Inc. Boston 1987.

CH 244 CHEMISTRY PRACTICALS IV 2 UNITS

Objectives
By the end of the course the students are expected to be able to:
Apply basic chemical techniques and methods in applied chemical experiments, and
Demonstrate some aspects of chemistry as given in the lectures.

Content:
A set of experiments based on the following topics: Common laboratory techniques in applied chemistry, calibration of basic equipment, Visible and UV spectroscopy, potentiometry, thermodynamics, statistical analysis of data and chemical separations .

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment: 100% Laboratory reports.

Textbooks:
Departmental Laboratory Manuals.
D.T. Sawyer, W.R. Heinemann and J.M. Beebe, Chemistry Experiments for Instrumental Methods, John Wiley and Sons Inc, N.Y. 1984.

CH 245 CHEMISTRY PRACTICALS V 2 UNITS

Objectives
By the end of the course the students are expected to be able to:
Apply basic chemical techniques and methods in applied chemical experiments, and
Illustrate some aspects of chemistry as given in the lectures.

Content:
A set of experiments based on the following topics: Common laboratory techniques in applied chemistry, chemical separations, IR and atomic spectroscopy, potentiometry, organic reactions, computer applications in chemistry, polarography and voltammetry.

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment: 100% Laboratory reports.

Textbooks:
Departmental Laboratory Manuals.

D.T. Sawyer, W.R. Heinemann and J.M. Beebe, Chemistry Experiments for Instrumental Methods, John Wiley and Sons Inc, N.Y. 1984.

CH 248 INSTRUMENTAL METHODS IN ANALYTICAL CHEMISTRY 2 UNITS

Objectives:

By the end of the course the students are expected to be able to:
Distinguish between analog and digital signals and the concepts of signal, noise, sensitivity, detection limit, resolution in instrumental analysis.
Choose a suitable instrumental method of analysis for a given analyte and matrix.
Explain the basic principles of several instrumental methods.

Content:

Analog and digital signals, concepts of signal, noise, sensitivity, detection limit and resolution in instruments. Basic instrumentation. Description of modern instrumental methods including: Electrochemical methods such as polarography, ion selective potentiometry and voltammetry, Spectroscopic methods such as UV visible, infrared and atomic absorption and emission. X-ray diffraction and fluorescence methods. Thermal analysis and Choice of methods.

Delivery: 30 lecture hours and 15 Tutorial hours .
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:

D. A. Skoog, F. J. Holler and T. A. Nieman, Principles of Instrumental analysis. 5th Ed. Saunders College Publishing, 1992.
G.W. Ewing, Instrumental Methods of Chemical Analysis, 5th Ed. McGraw-Hill New York 1985.
Rouessac, Francis; Rouessac Annix; Chemical Analysis: Modern Instrumental Methods and Techniques, John Wiley & Sons Inc. 2000.

CH 262 ANALYTICAL AND ENVIRONMENTAL CHEMISTRY 3 UNITS

Objectives

By the end of the course the students are expected to be able to:
Plan the chemical analysis to solve analytical problems in a systematic and quantitative manner
Describe a wide range of standard techniques that are useful in modern analytical chemistry
Apply statistical methods in assessment and interpretation of analytical data (results)
Explain the sources, transport, reactions, effects, and fates of chemical pollutants in the environment.
Describe environmental protection issues.

Content:

An introduction to the basic concepts, general problem-solving approach and strategies associated with the ubiquitous problems of chemical analysis. A theoretical discussion of the various stages in an analytical procedure: Problem formulation and planning (identifying and defining the problem, goals, objectives, hypotheses, activities, monitoring and evaluation), Sampling methods and strategies (sampling of air, water, soil, sediment, biota, and industrial manufacturing products), Sample preservation and storage, Sample preparation and processing (methods for removal of parts that are not to be analyzed, disintegrating solid samples, extraction, clean-up, preconcentration, dilution, and derivatization). Methods for the determination of trace concentrations of inorganic, organometallic and organic compounds in air, water, soil, sediment, biota and industrial manufacturing products (pharmaceuticals, foods, beverages, cosmetics, etc), Method validation, interpretation and evaluation of analytical results (Statistical data analysis: hypothesis testing, *F*-test, ANOVA, *t*-test, correlation tests), Reporting of results. Introduction to environmental chemistry: toxic chemicals, scope of environmental chemistry. Pollution: Atmospheric (air) pollution: Tropospheric chemistry, Stratospheric chemistry. Meaning and scope of air pollution, primary and secondary air pollutants. Major air pollutants (SO_2, NO_X, CO, CO_2, Volatile organic compounds, Particulate Matter, Atmospheric toxic metals e.g. lead and mercury) and their sources, transport, reactions, effects, and fates in the environment. The ozone layer, its formation, importance and depletion. Chemical factors affecting climate. Management of air pollution. Water and Soil Pollution: Meaning and scope of water and soil pollution, parameters used to assess water pollution, major water and soil pollutants: industrial effluent, agrochemicals (fertilizers and pesticides), sewage and municipal wastes. Effects of water and soil pollution, public health aspects, eutrophication. Water treatment. Persistent Organic Pollutants (POPs). Management of water and soil pollution, waste-water reclamation.

Delivery: 45 lecture hours and 15 Tutorial hours .
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
Fifield F.W. and Haines, P.J., Environmental Analytical Chemistry, 2nd ed. Blackwell Science, 2000.
Radojeric, M. and Bashkin, V., Practical Environmental Analysis, Royal Society of Chemistry, London, 1999.
References:
Skoog, D. A. Holler, F. J. and Nieman, T. A., Principles of Instrumental analysis, 6th Ed. Saunders College Publishing, 1992.
Ewing, G.W., Instrumental Methods of Chemical Analysis, 5th Ed. McGraw-Hill New York, 1985.
Phyllis Buell and James Girard, Chemistry: An environmental perspective, Prentice Hall, Englewood Cliffs, N.J., 1994.

CH 280 ORGANIC STRUCTURE, REACTIONS AND MECHANISMS 3 UNITS
Objectives:
By the end of the course the students are expected to be able to:
Explain the driving forces and mechanistic principles of organic reactions and mechanism.

Content:
Structure of organic compounds (molecular connectivity and molecular geometry), Electrophilic and nucleophilic substitutions, molecular rearrangement, elimination and addition reactions, oxidation and reduction reactions; Specificic organic reactions**:** Carbanion I (Acidity of hydrogens, Aldol, Claisen and Crossed Claisen condensation.Tautomerism, Dieckmann and Reformatsky reactions. Carbanion II (Malonic ester and aceto-acetic ester synthesis, polyfunctional compounds; Polynuclear aromatics, Michael addition reactions.

Delivery: 45 lecture hours and 15 Tutorial hours .
Assessment: Coursework, 40%, Final Examination 60%.

Text books:
1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part A & B, 3th ed. Plenum Press, N. Y. (1991).
2. J. March, Advanced Organic Chemistry, 4th ed. John Wiley &Sons, N. Y. (1992).
Reference:

1. R.O.C. Norman and J.M. Coxon, Principles of Organic Synthesis, 3rd ed. Blackie Academic & Professional, London, (1995).

CH 290 CHEMICAL KINETICS AND ELECTROCHEMISTRY 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
describe basic principles in chemical kinetics and electrochemistry.
apply the concepts of chemical kinetics and electrochemistry in chemistry experiments
use the concepts of chemical kinetics and electrochemistry in biological systems

Content:
Microscopic theories of reaction rate. Rate laws and their determination, Temperature dependence of reaction rates, Arrhenius Equation, activation energies, elementary collision theory. Rates of reactions. Order and molecularity. Experimental measurement of reaction rates (Differential method and integral method of analysis. Method of initial rates. Method of half-lives.), Reaction mechanisms: Elementary reactions, pre-equilibrium, steady state approximation: applications to unimolecular reactions (Lindemann), Kinetic isotope effect. Enzyme catalysed reactions. Electromotive force and galvanic cells. Electrolytic cells and the Faraday's laws of electrolysis. Electrolytes in solutions. The Debye-Huckel theory of interionic interaction and ionic activity coefficients.

Delivery: 45 Lecture hours and 15 Tutorial hours.
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
P. W. Atkins, Physical Chemistry. 7th ed. ELBS/Oxford Univ. press, 2002

CH 299 PRACTICAL TRAINING I 2 UNITS

Objectives:
By the end of the course students should able to:
Apply their chemistry theoretical knowledge in practice
Experience and practice chemical sciences in his/her specialization
Write scientific report related to activities of the host institution.

Content:
This is a field based course. The students will be integrated into the daily routines of the host institution. Emphasis will be on those activities related to chemistry aspects to acquaint the students with necessary experiences.

Delivery: 6-8 weeks of institutional attachment.
Assessment: Employer's report 10%, logbook 30%, Final report 50%, presentation 10%

CH 303 ORGANIC SYNTHESIS 3 UNITS

Objectives:
By the end of the course the students are expected to be able to:
understand how retrosynthesis analysis can be applied to the synthesis of complex organic compounds from simpler sub-structures and ultimately from readily available starting materials.

Content:

Principles of organic synthesis. Retrosynthesis, C-C bond formation using nucleophilic species: enolate anions, organometallic derivatives. C-C bond formation using electrophilic species: carbocations, metal stabilized cation reagents. Pericyclic C-C bond forming reactions. C-C bond formation via radicals and carbenes. C- heteroatom bonds. Reduction, oxidation, ring closure and opening. Protective groups. Silicon, boron, phosphorus, selenium reagents. Asymmetric synthesis.

Delivery: 45 Lecture hous and 15 Tutorial hours.
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:
1. S. Warren Organic Synthesis: The Disconnection Approach, J. Wiley & sons, 1997

CH 314 PROJECT WORK 3 UNITS
Objectives
By the end of the course a student should be able to:
Design and Develop a research proposal
Use their skills in making accurate measurements, analyzing data and interpreting results write and edit a scientific report.
Implement a research activity with minimum supervision
Write a sound scientific research report
Content
Students will carry out a supervised research project in chemistry. More emphasis will be given on research proposal formulation, experimental design and scientific report writing. A laboratory study of a problem in a selected field of chemistry leading to the preparation of a research project report.

Delivery: Equivalent to 135 hours of practical.
Assessment: Continuous Assessment 40% [(Oral presentation of proposal (10%) and final results (10%), Laboratory/field conduct: Log / Data book (20%)]; Final Assessment: Final report 60%.

Textbooks
1. Kothari, C.R. 1997. Research Methodology. Methods and Techniques. 2nd Edition.Wishwa Prakashan Publishers, pp. 887. (ISBN81-7328-036-3)

CH 323 ORGANIC SPECTROSCOPY 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
Describe the principles of different spectroscopic methods.
Apply the techniques in determination of structures of simple organic compounds.

Content:
Principles of spectroscopic techniques, Structure determination of organic compounds using infrared, ultra violet-visible, proton and carbon - 13 Nuclear Magnetic Resonance spectrophotometry and mass spectroscopy.

Delivery: 30 Lecture hous and 15 Tutorial hours.
Assessment – Coursework, 40%, Examination 60%.

Textbooks:

R. M. Silverstein, G. C. Bassler and T. C. Morill; Spectroscopic Identification of Organic Compounds., 5th ed. John Wiley and Sons, 1991.
Williams Dudley H; Fleming Ian; Spectroscopic Methods in Organic Chemistry; McGraw Hill Education – Europe (UK) 1995.

References
E. Breitmaier, Structure Elucidation by NMR in Organic Chemistry. John Wiley and Sons, New York, 1995.

CH 341 CHEMISTRY PRACTICALS VI 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
Apply the theoretical principles of chemistry as given in the lectures in carrying out related experiments.
Content:
A set of experiments based on the following topics: Modern separation methods including ion-exchange. Determination of the charge of complex ion. Factors affecting the stability of complexes. Identification of complex species by spectrophotometry. Stereochemistry and reaction mechanisms, Spectroscopic methods and chromatographic methods. Use of chemical literature. Electrochemical methods, such as polarography, ion selective potentiometry and voltammetry (including electrolytic conductivity and transport numbers)

Delivery: 60 hours of practical (4 hours laboratory session per week).
Assessment – 100% Laboratory reports.

Textbooks:

Departmental Laboratory Manuals.
Practicals in Physical Chemistry. T. Forland, G. Ndaalio and K. S. Forland. University of Dar es Salaam. 1980

CH 351 FORENSIC CHEMISTRY 2 Units
Objective
By the end of the course the students are expected to be able to:
Describe the analytical techniques associated with drug, food, poisons and explosives.
Apply these techniques in solving cases of crime in the society.

Content:
Introduction to forensic science and analysis, methods for drug identification, methods for toxicology determination, quality control in forensic analysis, drug screening by Immunoassay, TLC, GC-NPD and HPLC, spot testing for illicit substances and anabolic steroids, sample preparation of biological specimens/evidence, serological evidence and its analysis, DNA Analysis, Gunshot residue analysis, trace evidence analysis, hair and fiber analysis, paint evidence analysis, latent finger printing, arson establishment and headspace GC in forensic analysis.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:

G. Davis. Forensic Science, American Chemical Society, Washington, DC, 1986.
M. H. Ho. Analytical Methods in Forensic Chemistry, Ellis Horwood, Ltd., London, 1990.

CH 363 CHEMICAL WASTE MANAGEMENT 2 UNITS

Objectives:

By the end of the course the students are expected to be able to:
Describe chemical wastes and chemical waste management strategies in pollution prevention.

Content:

Types of chemical wastes, chemical waste analysis and chemical waste management strategies to include waste minimisation, recycling, onsite/offsite treatment, disposal. Physical methods: Containment, Engineered Landfills, Long Term Storage and Deep well Injection. Chemical methods: Incineration, Gas Phase Chemical Reduction, Electrochemical Oxidation, Molten Metal Oxidation, Solvated Electron Process (SET Process), Plasma Arc Process, Thermal Desorption – BCD/APEG, LasagnaTM Process, and Vitrification (Immobilisation). Biological methods: Bioremediation and Phytoremediation**.** 'Green' chemistry in waste prevention and ISO 14001.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:

Williams, P. T. Waste Treatment and Disposal, John Wiley and Sons Ltd, NY, 1998.
Ferrada, J. J. Hazardous Chemical Waste Management. 2000

References:

Tammemagi, H. The Waste Crisis: Landfills, Incinerators and the Search for a Sustainable Future, Oxford University Press Inc, USA, 2000.
Kharbanda, O. P. Waste Management: Towards a Sustainable Society E.A. Stallworthy Greenwood Press, 2000.

CH 364 COORDINATION CHEMISTRY 2 UNITS

Objectives:

By the end of the course the students are expected to be able to:
describe the basic concepts of coordination chemistry.
Apply coordination chemistry in the industrial processes and in daily life.

Content:

Introduction to coordination chemistry. Constitution and stereochemistry of coordination compounds. Hybridization and coordination numbers. Bonding in coordination compounds. Thermodynamic and kinetic stabilities of coordination compounds and their properties related to bonding. Chemical reaction of coordination compounds.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment – Coursework, 40%, Final Examination 60%.

Textbooks:

Complexes and First row Transition metals, D. Nicholls, MacMillan 1995.
J.E. Huheey, Inorganic Chemistry: Principles, Structure and Reactivity. Harper & Row, London.

CH 371 QUALITY CONTROL AND ASSURANCE 2 Units
Objectives:
By the end of the course the students are expected to be able to:
apply the principles of quality, good laboratory practices and good manufacturing practices
use these principles to attain, monitor and control the quality.

Content:
Principles of quality systems, elements of quality manuals, quality control and quality assurance activities that provide confidence for a product or a service. Good laboratory practices (GLP) and Good Manufacturing Practices (GMP). Control tools in monitoring quality. Quality management of sampling, records, personnel, equipment, supplies, methods of analyses, instrument performance, method validation, proficiency testing, and audits. Accreditation and International Standards Organisation (ISO) documents (ISO 17025 and 9001) as quality assurance requirements.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
1. **Tickle F. and Vorley G., Quality Management: Introduction to Quality, 3rd Ed.,QM and T Publication. 2002.**
2. Montgomery and Douglas C., Introduction to Statistical quality Control, John Wiley, 2001.

Reference
1. Garfield F.M., Klesta E. and Hirsch J., Quality Assurance Principles for Analytical Laboratories, 3rd ed., AOAC International, Gaithersburg, MD USA, 2000.

CH 377 - INDUSTRIAL CHEMISTRY 3 UNITS
Objectives:
By the end of the course the students are expected to be able to:
Describe the general features of the industrial inorganic chemistry amd metallurgy
Describe the inorganic chemistry used in the manufacture of various industrial products relevant to Tanzanian economy
Survey and comprehend organic raw materials, reactions and products of significance to the Tanzania chemical industry.

Content:
Importance of industrial chemistry. Characteristics of the chemical industry. Sources of chemicals. General features of industrial inorganic chemistry and metallurgy. Thermodynamics and phase diagrams involved in various processes. Iron and steel making. Sulphur, phosphorus and nitrogen industries. Chemistry of cement, ceramics and refractories. Pulp and paper industry. Raw materials for organic chemical industries, pesticides, dyes and their intermediates; fats oils and waxes; soaps and detergents; chemical processing of wood, cellulose and derived products; fermentation processes. Environmental impact of the chemical industry.

Delivery: 45 Lecture hours and 15 Tutorial hours.

Assessment – Coursework, 40%, Examination 60%.

Textbooks:

Buchel K. H. Industrial Inorganic Chemistry translated by David R. Terrell. Weinheim Chichester Wiley-VCH 2000.
Kingery, W. D. *et al.* Introduction to Ceramics.
Reuben, B.G. Industrial Organic Chemicals in Perspective. Vol. I & II, Wiley & Sons, 1980.

Reference
Rosenqvist T.: Principles of Extraction Metallurgy McGraw Hill. 1988.

CH 379 ORGANOMETALLIC CHEMISTRY 3 UNITS
Objectives
By the end of the course the students are expected to be able to:
describe the fundamental mechanistic basis of organometallic chemistry,
describe the properties of the metal-carbon and metal-hydrogen bonds and how these bonds influence the synthesis of organometallic compounds, and
describe the industrial applications of organometallic compounds.

Content:
Bonding, synthesis, structure, and stoichiometry (the EAN rule) of organometallic complexes. Reactivity of sigma-bonded alkyls and aryls, metal carbonyls and pi-bonded organic ligands such as alkenes, alkynes, allyls, and arenes. Applications of organometallic complexes in organic synthesis and industrial catalysis.

Delivery: 45 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
M. Bochmann. Organometallics 1 & 2, (Zeneca series no. 12 & 13) Oxford Science Publications. 1994.
P. Powell. Principles of Organometallic Chemistry, Second Edition. Kluwer Academic Publishers, 1998.

CH 391 ADVANCED ELECTROCHEMISTRY 2 UNITS
Objectives
By the end of the course the students are expected to be able to:
describe electrode kinetics, mechanisms, electrochemical processes and measurements.

Content:
Electrode kinetics and Mass transport; Electrode-Solution interface: over potential, ohmic, activation and concentration polarization Nernst diffusion layer; Tafel equation, i-V polarization principles; Principles, mechanisms and control of corrosion; Industrial applications: fuel cells, batteries and electroplating; Electrochemical techniques: impedance spectroscopy, cyclic voltametry, potentiodynamic polarization etc.

Delivery: 30 Lectures and 15 Tutorials
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
1. E. Gileadi: Electrode Kinetics for Chemists, Chemical Engineers and Material Scientists, VCH 1993.

2. J.S.Newman. Electrochemical Systems. 2nd ed. Prentice Hall 1991.

References

A. C. Fisher; Electrode Dynamics; Oxford University Press, Oxford, 1998
I. Rubinstein. Physical Electrochemistry principles, methods and applications. Marcel Dekker Inc., New York, 1995.
Southampton Electrochemistry group. Instrumental methods in electrochemistry. Ellis Horwood, New York 1990.
Trethewey, K.R. and Chamberlain J.: Corrosion for students of Science and Engineering, Longman, 1988.

CH 394 FUNDAMENTALS OF THEORETICAL CHEMISTRY 3 UNITS

Recommendation: It is strongly recommended that students taking this course have already passed CH 173, CH 191, and CH 201 or equivalent courses.

Objective:
By the end of the course the students are expected to be able to:
Describe basic concepts applied in quantum chemistry, statistical mechanics and group theory.
Apply these concepts to solve problems in each of the given areas.

Content:
The postulates of Quantum Mechanics. Solutions of the time independent Schrödinger equation for a particle-in-a-box, vibration and rotation. Electron spin and the Pauli principle. Atomic terms. Molecular orbital theory reviewed. Molecular Energy Level Thermodynamics (MELT) Theory and its relationship to classical thermodynamics; the canonical ensemble and the molecular partition function for classical non-interacting particles. Derivation of the Boltzmann distribution. Distinguishable and non-distinguishable particles. Calculation of equilibrium constants for simple reactions from molecular energy levels. Group theory and its application to vibrational spectra of simple polyatomic molecules. Symmetry adapted orbitals and bonding in simple polyatomic molecules.

Delivery: 45 Lecture hours and 15 Tutorial hours.
Assessment – Coursework 40%, Final Examination 60%.

Textbooks:
L.I. Noel, Quantum Chemistry, Prentice-Hall, 2000.
F. A. Cotton: Chemistry Applications of Group Theory, 2nd ed., Wiley Eastern Ltd. 1992.
References:
P. W. Atkins, Physical Chemistry. 6th ed. ELBS/Oxford Univ. press, London, 1998
J.C. Anderson, K. D. Leaver, J. M. Alexander and R. D. Rawlings Materials Science, 2nd ed. Chapman & Hall, 1990.

CH 399 CHEMISTRY PRACTICAL TRAINING II 2 UNITS
Objectives:
By the end of the course students should able to:
Apply their chemistry theoretical knowledge in practice
Experience and practice chemical sciences in his/her specialization
Write scientific report related to activities of the host institution.

Content:

This is a field based course. The students will be integrated into the daily routines of the host institution. Emphasis will be on those activities related to chemistry aspects to acquaint the students with necessary experiences.

Delivery: 6-8 weeks of institutional attachment.
Assessment: Employer's report 10%, logbook 30%, Final report 50%, presentation 10%

OPTIONAL COURSES:

CH 293 SOLID STATE CHEMISTRY 2 UNITS
Objective
By the end of the course the students are expected to be able to:
correlate the structure of crystalline materials with its properties.

Content:
Introduction to Group theory of molecules and ions. Basic crystal structures of the elements and simple ionic compounds. Packing. Crystal planes. Structural defects. Intermolecular forces: Nature and properties of metals (conductors), semiconductors and insulators (non conducting solids). Structure of clays and some simple minerals.

Delivery: 30 Lecture hourss and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
A.R. West. Solid State Chemistry and its Applications, Wiley & sons 1984.
J. E. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed.

CH 305 CHEMISTRY OF NATURAL PRODUCTS 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
describe the major groups of natural products
explain the chemistry and biosynthesis of natural products belonging to these groups.

Content:
Natural Products: Primary and Secondary Metabolites. Major classes of Natural Products such as Polyketides, Terpenoids, Flavonoids, and Alkaloids. Antibiotics and Essential Oils. Principal Biosynthetic Pathways, Isolation and Identification, Selected chemical Transformations and syntheses of Natural Products.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Examination 60%.

Textbooks:
Kurt B.G. Torsell, Natural Product Chemistry, Wiley & Sons, 1983.
J. Mann, R.S Davidson, J.B. Hobbs, D.V Banthape and J.B Harbone, "Natural Products", Longman, UK 1994

CH 308 POLYMER CHEMISTRY 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
describe the physical and chemical properties of polymers.

illustrate how the polymer properties are of importance in the usage of polymeric materials.

Content:
Types and nature of polymers, addition and condensation polymers, copolymers. Polymer characterization: degree of polymerization. Determination of average molar mass and polymer molar mass distribution. Techniques of polymerization: Bulk-, Emulsion-, Suspension- and Solution polymerization. Mechanism and kinetics of chain and step polymerizations. Polymer solubility. Mechanical/physical behaviour of polymers. Application of polymers as: fibres, plastics, rubber, resins/adhesives and thermosets. Polymer degradation and stabilization, biodegradation and recycling of plastics.

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Examination 60%.

Textbooks:
F.W. Billmeyer: Textbook of Polymer Science 3rd ed. J. Wiley & Sons, 1984.
G. Odian: Principles of Polymerization, J. Wiley & Sons, 1991.

CH 315 SURFACE AND COLLOID CHEMISTRY 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
Describe the basic theories and principles of surface and colloidal chemistry.
Explain the principles of adsorption/desorption at the surface

Content:
Colloidal systems: Classification and preparation, properties, surface structure and stability. Properties of liquid surfaces: surface tension, curved surfaces, capillary action. Surfactants, emulsions and foams. Solid surfaces: surface growth, surface composition. The extent of adsorption: Physisorption and chemisorption, adsorption isotherms, the rates of surface processes. Catalytic activity at surfaces: adsorption and catalysis, examples of catalysis. Rheology.

Delivery: 30 Lecture hours and 15 Tutorial hours
Textbooks:
D. J. Shaw, Introduction to Colloid and Surface Chemistry, Butterworths, London
B. Akhmetov, Yu, Novichenko, V. Chapurin, Physical and Colloid Chemistry, Mir Publishers Moscow

CH 318 MEDICINAL AND PESTICIDE CHEMISTRY 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
Describe the basic medicinal chemistry
Explain the basic pesticide chemistry

Content:
The chemistry of antibiotics, antimalarials, sedatives, hypnotics and other pharmaceuticals. Drugs: design and action. Pesticides: chemistry, mode of action.
Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Examination 60%.

Textbooks:
K.H. Buchel (Ed), Pesticide Chemistry, John Wiley and Sons, (1983)

S.M. Roberts & B. J. Price Medicinal Chemistry, Academic Press, 1995

CH 331 CHEMOMETRICS **2 UNITS**
Objectives
By the end of the course the students are expected to be able to:
design optimal chemical experiments, and
use chemometric methods to analyse chemical data.

Content:
Experimental design. Multivariate data analysis, including Principal component analysis (PCA). Building Linear Predictive models, including Principal Component Regression (PCR) and Projection to Latent Structures by means of Partial Least Squares (PLS).

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
J.N. Miller and J.C. Miller, Statistics and Chemometrics for Analytical Chemistry 4th ed. Prince Hall, London, 2000.
Umetrics AB. Introduction to Multi- and Mega-variate data analysis. 1998.

CH 350 COMPUTERS IN CHEMISTRY **2 UNITS**
Objectives:
By the end of the course the students are expected to be able to:
acquire basic knowledge of computer in relation to chemistry.
use the computer for acquisition and handling of analytical data and for chemical analysis.

Content:
Introduction to computers, computer architecture, system software, operation programme and programming. Interfacing of computer to laboratory instrumentation. Typical application of computers for chemists including data acquisition, analysis and presentation using specialized scientific software. Use of chemical databases and chemistry on the www and the internet.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Examination 60%.

Textbook:
T J. Zielinski and M L.Swift: Using Computers in Chemistry and Chemical Education, Barnes & Nobles. 1997.

CH 353 BIOCHEMISTRY **2 UNITS**
Objectives:
By the end of the course the students are expected to be able to:
describe the chemistry and functions naturally occurring macromolecules
explain the metabolic pathways of naturally occurring macromolecules.

Content:
Chemistry and functions of principle naturally occurring macromolecules carbohydrates, polysaccharides and proteins; Enzymes and hormones. Cell organization. Bioenergetics. Metabolic pathways. Protein synthesis. Neurotransmitters.
Delivery: 30 Lecture hours and 15 Tutorial hours

Assessment: Coursework, 40%, Examination 60%.

Textbook:
L. Stryer: Biochemistry, 3rd ed. W.H. Freeman 1988.

CH 355 FOOD AND BEVERAGE CHEMISTRY 2 UNITS
Objectives
By the end of the course the students are expected to be able to:
explain the basic concepts of food chemistry and technology
describe the processes involved in the manufacture of various beverages including wines, liquors etc.

Content:
Food components: carbohydrates, lipids, proteins and vitamins. Food coloring and aroma. Food and milk processing. Food by-products processing. Sugar industry. Starch and related polysaccharides. Fermentation industries: wine, liquors. Quality preservation and hygiene in food processing.

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks
H.D. Belitz and W. Grosch. Food Chemistry, Springer Berlin, 1987.
T.P. Coultate. Food: The Chemistry of its components, 2nd ed. The Royal Society of Chemistry, London, 1988.

CH 357 FUEL CHEMISTRY AND TECHNOLOGY 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
Describe the nature, compositions and properties of fuels.
Describe the chemical and physical processes involved in oil refinery
Acquaint themselves with the technological developments/progress in the fuel industry.

Content:
Natural fuels, origin and reserves. Chemical composition, combustion properties and classification of coals. Coal fields and coal resources in Tanzania. Liquid and gaseous fuels. Refining, composition and properties of synthetic fuels. Elements of fuel technology, heat balance, safety and antipollution methods.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Textbooks:
Norbert Berkonwitz; Fossil Hydrocarbons: Chemistry and Technology, Academic Press.
Norbert Berkonwitz; The Chemistry of Coal, Coal Science and Technology No. 7.
Reference
Harold H. Schobert; The Chemistry of Hydrocarbon Fuels - Butterworth-Heinemann Ltd. 1995.

CH 358 CORROSION AND CORROSION PROTECTION 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
Identify the electrochemical/thermodynamic basis of corrosion
Realize the significance of the problems of corrosion.

Survey various techniques of corrosion protection

Content:
Definition and importance of corrosion, the thermodynamic basis of corrosion. The Pourbaix diagram. Reduction processes, reaction kinetics of corrosion processes, corrosion current and corrosion potential, passivity, types of corrosion and corrosion protection (electrochemical techniques, chemical treatment of the environment, surface treatment)

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Examination 60%.

Textbooks:
Trethewey, K.R. and Chamberlain J.: Corrosion for Students of Science and Engineering, Longman, 1988.

CH 362 STRUCTURAL METHODS IN CHEMISTRY 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
Apply more advanced aspects of spectroscopy and modern spectroscopic methods for the identification of complex organic molecules and natural products.

Content:
Basics of Fourier Transform NMR and its advantages. 1D NMR applications such as double resonance, nOe difference spectroscopy, 2D NMR applications such as homonuclear correlation, heteronuclear correlation, including long range correlations. NMR and chirality. NMR and dynamic processes. MS instruments, ionisation techniques, fragmentation rules and interpretation of MS spectra. The use of these modern spectroscopic methods for the identification of complex organic molecules and natural products.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Examination 60%.

Textbooks:
E. Breitmaier; Structure Elucidation by NMR in Organic Chemistry. J. Wiley and Sons, New York, 1995.
R. M. Silverstein, G. C. Bassler and T. C. Morill, Spectroscopic Identification of Organic Compounds, 5^{th} Ed. John Wiley and Sons, 1991.

CH 374 BIO-INORGANIC CHEMISTRY 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
explain the importance of metal ions in biological systems
describe the structure and function of metal ion sites in biomolecules.

Content:
Metal coordination environments in biology. Iron transport and storage, oxygen binding in mammals and lower organisms, the use of model compounds as probes of biological structures. Electron transfer, the toxicity of inorganic species, the use of metal complexes as drugs. Platinum anticancer drugs, discovery of *cis*-platin. Metal toxicity, electron transfer in biology, Redox activation of N_2. Alkali metals ions and nitric oxide in communication.

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbook:
W. Kaim and B. Schwederski, Bio-inorganic Chemistry: Inorganic Elements in the Chemistry of Life, Wiley, N.Y., 1994.

CH 381 PHYSICAL ORGANIC CHEMISTRY 2 UNITS
Objective:
By the end of the course the students are expected to be able to:
rationalize, control and predict the behaviour and outcome of organic reactions by examining the qualitative aspects of physical organic chemistry such as steric effects, stereoelectronic effects, conformational analysis, orbital symmetry etc.

Content:
Various aspects of physical organic chemistry are treated. These include basic principles such as the preparation, stability and reactions of reactive intermediates eg. carbonium ions, carbanion, radicals and carbenes. Various factors which influence reaction rates, reaction sites and direction of incoming groups, as well as the stereochemical outcome of products will be discussed in the course.

Delivery: 30 Lecture hours and 15 Tutorial hours.
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks
1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part A & B, 3th ed. Plenum Press, N. Y. (1991).
2. J. March, Advanced Organic Chemistry, 4th ed. John Wiley &Sons, N. Y. (1992).

Reference
R.O.C. Norman and J.M. Coxon, Principles of Organic Synthesis, 3rd ed. Blackie Academic & Professional, London, (1995).

CH 382 BIO-ORGANIC CHEMISTRY 2 UNITS
Objectives:
By the end of the course the students are expected to be able to:
describe the role of organic chemistry in biological systems.
explain the structure and reactivity of the small organic building block of polymeric bio-molecules and their function in living cells, and
apply the concepts of bio-organic chemistry in the pharmaceutical, biotechnological, biochemical and medical sciences after gradution.

Content:
Enzymology: Basic Kinetics and Michaelis-Menten Equation, equilibrium and steady state assumptions; Enzyme inhibition; Serine proteases: structure, selectivity and kinetics; Transition state theory as applied to enzymes: Entropy effects on enzyme reactions, transition state stabilization, transition state analogues as inhibitors; Ion channels, receptors, and blockers; Chemical biology: Ca sensors and caged compounds; Cofactor Chemistry: NADPH, Pyridoxal, Flavins, folate, biotin, thiamine; Nucleic acid chemistry: DNA and RNA structures, design of specific DNA binding and cleaving agents, catalysis of RNA, Amino acids and proteins; Sugars and carbohydrates; Lipids.

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
C.M. Dobson, J.A. Gerrard and AJ Pratt. Foundations of Chemical Biology, Oxford University Press, Oxford, 2002.
H. Hermann. Bio-Organic Chemistry, 3rd ed. Springer-Verlag, New York, 1999.

Reference
J. McMurry. Organic Chemistry, 6th Ed., Brooks/Cole Publishing Co., Belmont, 2003.

CH 393 MOLECULAR MODELLING 2 UNITS
Objectives
By the end of the course the students are expected to be able to:
describe how classical and quantum modelling is used in Chemistry to understand and predict molecular structures and properties.
Apply molecular simulation techniques in areas such as surface chemistry, industrial chemistry, drug design and others
Content:
Molecular mechanics with empirical force fields, modeling conformational changes in organic molecules. Molecular simulation using Monte Carlo and Molecular Dynamics techniques. Quantum molecular modeling of structure and properties of molecules. Application of these techniques in areas such as solid state chemistry, surface chemistry, industrial chemistry, drug design and understanding liquids, gels and liquid crystals.

Delivery: 30 Lecture hours and 15 Tutorial hours
Assessment: Coursework, 40%, Final Examination 60%.

Textbooks:
Chris Cramer; Essentials of Molecular Modelling, Wiley, London, 2002.
A. R. Leach; Molecular Modelling. Principles and Applications, Longman, 1996.