

Description of Chemistry Department Courses

1	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 110	General Chemistry I	3	-	3	-

Course Objectives:

The course aims to introduce students to basic knowledge and principle in chemistry.

▪ Course Description:

It provides an introduction to the general principles of chemistry for students planning a professional career in chemistry, a related science, the health professions, or engineering. By the end of this course the student will be able to understand the following: Significant figures, scientific notation and units, stoichiometry, atomic structure & periodic table, chemical bonding, gases, ionic equilibrium, basic principles of organic and basic principles of biochemistry.

Main text books:

- Chemistry, by Chang, 9th. ed., 2007, McGraw-Hill.
- Chemistry, by Steven S. Zumdahl, 6th ed., Houghton Mifflin College Div.

Subsidiary books:

- Chemistry, by Mortimer, 6th ed., Wadsworth Inc.

2	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 200	General Laboratory Safety	1	0	1	-

▪ **Course Objectives:**

To provide students with an overview of the General Laboratory Safety Standard, including physical and health hazards of the chemicals, toxins, biological samples, and radiation in the work area, measures students can take to protect themselves from these hazards, emergency procedures, and personal protective equipment.

▪ **Course Description:**

Introduction to the general Laboratory Safety standards for students planning a professional career in chemistry, a related science, the health professions, or engineering. By the end of this course the student will be able to work safely in different laboratories. The students will be able to understand the following: the meaning of Safety, Different sources of hazard in the laboratory, what they should know before starting laboratory work, symbols and color codes, what they should do before leaving the laboratory. how to work safely with hazardous materials, creating a designated area for work, procedures (general and operational), the protective safety equipments, fire and fire extinguishers, chemical hazards and health, hazards, risks and toxicology, Material Safety Data Sheets (MSDS), classifications of hazardous chemicals, Transportation of Dangerous Goods (TDG), Dispose Dangerous Goods, laboratory emergencies and first aid.

Main text books:

CRC Handbook of Laboratory Safety, 5th Edition by A. Keith Furr.

ISBN-10: 0849325234

ISBN-13: 978-0849325236

Handbook of Laboratory Health and Safety, 2nd Edition by R. Scott Stricoff and Douglas B. Walters. Wiley-Interscience

ISBN-10: 047102628X

ISBN-13: 978-0471026280

3	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 281	General Chemistry	-	3	1	Chem 110

Objectives of the course:

The course aims to introduce students to basic knowledge and principle in chemistry labs.

Course Description:

Safety rules, Chemical nomenclature, Acid radicals; Dil. HCl group Acid radicals; Conc. H₂SO₄ group General group, General scheme for testing acid radicals + unknown, Basic radicals (1-6), General scheme for testing base radicals + unknown; Determination of the molecular weight of the volatile solution's vapor; Determination of percentage and number of molecules of water of crystallization; Titration using different indicators; 1- Determination of solubility product of sparingly soluble salt, 2- effect of common ion effect on the solubility

Main text books:

- Chemical principles in the Laboratory with quantitative analysis, Slowiski. Wolsey. Masterton 6th ed., 1997 Brooks/Cole.

Subsidiary books:

- Practical Experiments in Chemistry, Kim Gogarty, Col Harrison, Grahame Dobinson, 1st ed., Blake Education 2007.

4	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 202	General Chemistry II	3	3	4	Chem 110

Course Objectives:

The course aims to give students an introduction to liquids and solids, chemical kinetics, thermo-, electro-, and nuclear-chemistry.

Course Description:

Thermo chemistry, gases, liquids, solutions, chemical kinetics, oxidation-reduction reactions, chemical thermodynamics, electrochemistry, nuclear chemistry, environmental effects.

Main text books:

- Chemistry, by Chang, 9th. ed., 2007, McGraw-Hill.

Subsidiary books:

- Chemistry, by Mortimer, 6th ed., 1986, Wadsworth Inc.
- Chemistry, by Steven S. Zumdahl, 6th ed., Houghton Mifflin College Div.

5	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem *	General Chemistry for Lab Technicians	2	3	3	-

Course Objectives:

The course aims to introduce the students to some basic concepts in chemistry required for chemistry lab technicians.

Course Description:

Structure of atoms and the periodic table - chemical equations and oxidation-reduction reactions; solutions, concentration units, acids and bases, pH, indicators, titration of solutions, introduction to organic chemistry, qualitative analysis of elements

Main text books:

- General Chemistry, by Chang, 9th ed., 2007, MacGraw-Hill.

Subsidiary books:

- Chemistry, by Steven S. Zumdahl, 6th ed., Houghton Mifflin College Div.
- Chemistry, by Mortimer Wadsworth Inc. 6th ed., 1986

6	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 210	Analytical Chemistry for non-Chemists	3	3	4	-

Course Objectives:

Giving the theoretical and experimental basis of volumetric and gravimetric analyses and introduction of some instrumental methods of analysis.

Course Description:

Basic principles of analytical chemistry. Volumetric analysis which includes : units of concentration, acid-base titrations, redox titrations , precipitation titrations and complex formation titrations. Gravimetric analysis which includes, solubility product constant and factors affecting the solubility of precipitates, calculations based on gravimetric analysis, formation of precipitate and their classification, classification of impurities, processes of improving precipitate properties. Introduction of some instrumental methods of analysis.

Main text book:

- Fundamentals of Analytical Chemistry, D.A.Skoog, D.M.West,F.J.Holler and s.R.Crouch, 8th ed., 2004, Brooks/Cole.

Subsidiary books:

Analytical Chemistry, "Theoretical and Metrological Fundamentals", k.Danzer, 1st ed.,2006, Springer.

7	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 211	Chemistry of Volumetric and Gravimetric Analysis	3	3	4	-

Course objective:

Study the theoretical and experimental basis of different kinds of titrations and gravimetric analysis and their applications

Course Description

Fundamentals of volumetric analysis, units of concentration, acid-base titrations, redox titrations, precipitation titrations, complexometric titrations. Gravimetric analysis which includes: solubility product constant and factors affecting the solubility of precipitates formation of precipitates and their classification, classification of impurities, processes of improving the precipitates. Inorganic and organic precipitating agents and calculation in gravimetric analysis.

Main text book:

- Fundamentals of Analytical Chemistry, D.A.Skoog, D.M.West, F.J.Holler and S.R.Crouch, 8th ed., 2004, Brooks/Cole.

Subsidiary books:

- Analytical Chemistry, "Theoretical and Metrological Fundamentals", K.Danzer, 1st ed., 2006, Springer.

8	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 220	Inorganic Chemistry for Non-Chemistry students	3	-	3	-

Course objective:

A course designed to give non-chemistry students back ground in the chemistry of the various groups of the periodic table and the physical bases upon which it depends.

Course Description:

Elements, their electronic configuration and the chemical state of their existence in nature, solid state, Ionic bond, covalent bond metallic bond, geometry of molecules and VSEPR theory; properties of some metals; transition elements and complex compounds, types of legends; stereochemistry in complexes; crystal and legend field theories, magnetic properties; electronic spectra.

Main text books :

- Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gauss 3rd. ed., 1995, Wiley & Sons.

Subsidiary books:

- Inorganic Chemistry, A.G. Sharpe, 1992, Longman Scientific and Technical.

9	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 221	Inorganic Chemistry I	3	-	3	Chem 202

Course Objectives :

Introduction to the basic theories and principles of Inorganic Chemistry. Special emphasis on applications to the chemistry of Main Group Elements.

Course Description

Systematic introduction to theories of electronic and molecular structure, including quantum chemistry, molecular orbital, valence bond and VSEPR approximations; molecular geometry; thermodynamics of inorganic chemistry including ionic bonding in solids; acid-base theories; redox reactions; chemical forces and finally applications to the chemistry of main group elements .

Main text books :

- Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gauss 3rd. ed., 1995, Wiley & Sons.

Subsidiary books:

- Inorganic Chemistry, A.G. Sharpe, 1992, Longman Scientific and Technical.

10	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 230	Organic Chemistry for non-Chemists	3	3	4	Chem.110

Course objective

Giving the theoretical and experimental basis of organic chemistry for non-chemistry students.

Course Description:

Study the chemical bonding in organic compounds through the hybridization theory, classifications of organic compounds according to functional groups, nomenclature of organic compounds, isomerism, chemical reactions, heterocyclic organic compounds, carbohydrates, amino acids and proteins, terpenes, application of organic compounds in medicine, agriculture and food industries.

Main text books:

- Organic chemistry, by Graham Solomons TW, Craig B Fryhle, 8th ed., 2007.

Subsidiary books:

- Organic Chemistry, by J. McMurry, 6th ed., 2003, Brooks/Cole Publishing Company.
- Organic Chemistry, by Fessenden & Fessenden; 6th ed., 1998, I.T.P.

11	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 231	Principles of Organic Chemistry I	3	3	4	Chem 202

Course Objectives :

This course aims to give a detailed discussion about the electronic structure of the elements, nomenclature of nonfunctional molecules, isomerism, common and important reactions of different classes of organic compounds.

Course Description

Classification and nomenclature of organic compounds, bonding, isomerism, reactions of mono functional organic compounds.

Main text books:

- Organic chemistry, by Graham Solomons Tw, Craig B Fryhle, 8th ed., 2007.

Subsidiary books:

- Organic Chemistry, J.McMurry, 6th ed., 2003, Brooks/Cole Publishing Company.
- Organic Chemistry, Morrison and Boyd, 6th ed., 1992, Allyn and Bacon.

12	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 232	Principles of Organic Chemistry II	3	3	4	Chem 231

Course Objectives:

The aim of this course is to give the student a detailed study about the chemistry of organic compounds with poly-functional groups.

Course Description:

Polyunsaturated hydrocarbons and Dienes, α,β -unsaturated carbonyl compounds, dicarbonyl compounds, dicarboxylic acids and their esters, halogen and hydroxyl acids - stereochemistry and carbohydrates, polynuclear aromatic hydrocarbons – alicyclic compounds.

Main text books:

- Organic chemistry, by Graham Solomons Tw, Craig B Fryhle, 8th ed., 2007.

Subsidiary books:

- Organic Chemistry, Morrison and Boyd , 6th ed., 1992, Allyn and Bacon.
- Organic Chemistry, J. McMurry, 6th ed., 2003, Brooks/Cole Publishing Company.
- Organic Chemistry, by I.L.Finar, Vol I &II, 6th 1973, Longman.

13	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 240	Physical Chemistry for Non-Chemistry Majors	3	3	4	-

Objectives of the course:

The course aims to give non-chemistry students basic principles in physical chemistry.

Course Description

Thermodynamic systems; first, second and third law of thermodynamics; free energy functions and their applications, chemical equilibria, phase equilibria, electrochemical cells, kinetics, theory of gases, chemical kinetics and reaction rates.

Main text books:

- Physical Chemistry, R. Alberty & R. Silby, 2nd ed., 1992, John Wiley & Sons.

Subsidiary books:

- Physical Chemistry, J. de Paula & P. Atkins, 7th ed., 2001, W. H. Freeman.

14	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 241	Chemical Thermodynamics	3	-	3	Chem 202, Math 202

Objectives of the course:

The course aims to introduce students to the first, second and third law of thermodynamic systems, properties of chemical equilibrium systems, phase equilibrium, and electrochemical cells.

Course Description:

Thermodynamic systems the first, second and third laws of thermodynamics and their applications; Free energy functions and criteria for the equilibrium state; Maxwell's equations; chemical equilibria, phase equilibria, electrochemical cells, activity functions and the standard electrode potentials and general applications, the chemical potential, partial molar quantities, free energy and chemical equilibrium, free energy of formation, effect of temperature on equilibrium constant, applications.

Main text books:

- Physical Chemistry, R. Alberty & R. Silby, 2nd ed., 1992, John Wiley & Sons.

Subsidiary books:

- Physical Chemistry, J. de Paula & P. Atkins, 7th ed., 2001, W. H. Freeman.

15	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 242	Quantum Chemistry and Statistical Thermodynamics	3	-	3	Chem 241

Objectives of the course:

The course aims to give the students the basic principals in quantum chemistry and statistical thermodynamics

Course Description:

Quantum theory; Quantum mechanics of simple systems; the hydrogen Atom , the electronic structure of multielectron atoms, introduction to statistical thermodynamics.

Main text books:

- Quantum Chemistry, by McQuarrie, 1997, University science Books.

Subsidiary books:

- Physical Chemistry, J. De Paula & P. Atkins, 7th ed., 2001, W. H. Freeman.
- Physical Chemistry, R. Alberty & R. Silby, 2nd ed., 1992, John Wiley & Sons.

16	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 312	Instrumental Methods of Analysis	3	3	4	Chem 211

Course Objectives:

The course aims to give students an introduction to the basic theoretical and practical of instrumental methods of analysis.

Course Description:

Spectroscopic methods which include: introduction in spectroscopy, Laws of radian absorption, theoretical basis and applications of molecular absorption in infrared, visible and ultraviolet ranges, molecular fluorescence and phosphorescence, atomic absorption and emission, Electrochemical methods which includes: introduction to electrochemistry, basis of electric methods in chemical analysis, Volumetric and polarographic methods, amperometric titrations.

Main text book:

- Principals of Instrumental analysis, D.S.Skoog, F.J.Holler and T.A.Nieman, 5th ed., 1998, Brook/cole.

Subsidiary book:

- Ewing's Analytical Instrumentation Hand book, J.Cazes, 3rd ed., 2004, CRC

17	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 313	Chromatographic methods of separation	2	3	3	Chem 211

Course Objectives:

The course aims to give students an introduction to the theoretical and practical principles of chromatographic methods of separation. Determination of organic and inorganic compounds in mixtures.

Course Description:

Theoretical principles of chromatography, thin layer and paper chromatography, ion exchange, liquid chromatography, gas chromatography.

Main text books:

- Fundamentals of Analytical Chemistry, D.A.Skoog, d.M.West, F.J.Holler and S.R.Crouch, 8th ed., 2004, brooks/Cole.
- Principals of Instrumental analysis, D.S.Skoog, F.J.Holler and T.A.Nieman, 5th ed., 1998, Brook/cole.

Subsidiary book:

- Ion Chromatography “Modern analytical Chemistry”, H.Small, 1st ed., 2001, Springer.

18	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 322	Inorganic Chemistry II	3	-	3	Chem 221

Course Objectives:

A systematic presentation of theoretical aspects of Inorganic Chemistry as applied to transition metal chemistry. Also discussing the stereochemistry, kinetics, thermodynamics and spectroscopy of coordination compounds and their reactions.

Course Description:

Types of ligands, Nomenclature of coordination complexes and IUPAC rules, Symmetry point groups and structure, Coordination numbers and geometry, Isomerism, preparative methods, mechanism of bonding in linear M-CO bonds, Factors affecting the stability of complexes, Stability of complex metal ion in aqueous solutions, chelate-effect, magnetic properties of a chemical substances, magnetic susceptibility and magnetic moments, electronic structure of transition metals, Bonding theories in coordination compounds, valence bond theory(VBT), crystal field theory(CFT), molecular orbital theory(MOT) of O_h and T_d complexes, Angular overlap model(AOM).

Main text books:

- Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, 6th ed., 1999, J. Wiley & Sons.
- Inorganic Chemistry; Principles of structure and Reactivity, J. E. Huheey, E. A. Keiter, R. L. Keiter, 4th ed., 1997, Harper Collins.

Subsidiary books:

- Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J. Alexander, 3rd ed., 1994, John Wiley & Sons.

19	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 323	Experimental Inorganic Chemistry	-	9	3	Chem 322

Course Objectives:

This laboratory course is designed to give the students a background in syntheses and characterization of transition metal complexes and their reactions.

Course Description:

Selected experiments in inorganic chemistry including; syntheses and characterization of transition metal complexes (use of i.r., u.v.-vis. and nmr spectroscopy); physico- chemical experiments including; kinetics, thermodynamics, magnetic, conductometric and optical methods.

Main text books:

- Synthesis and Technique in Inorganic Chemistry: A Laboratory Manual, G. S. Girolami, T. B. Rauchfuss and R. J. Angelici, 3rd ed., 1999, University Science Books.

Subsidiary books:

- Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, 1st ed., 1991, Waveland press.

20	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 333	Spectra of Organic Compounds	2	3	3	Chem 232

Course Objectives:

The major aim of this course is to develop skills in elucidation of molecular structure using modern spectroscopic instrumentations.

Course Description:

UV and visible spectroscopy, IR spectroscopy, NMR spectroscopy, Mass spectroscopy. Using the techniques to elucidate the molecular structures.

Main text books:

- Interpreting Organic spectroscopy, D. Whittaker, Royal Soc. Chem., 2000.

Subsidiary books:

- Introduction to Spectroscopy, D. M. Pavia & others, 1997, Saunders Co. Pub.

21	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 334	Physical Organic Chemistry	2	-	2	Chem 333

Course Objectives:

The course aims to give the students an introduction to understand the techniques used to in reaction mechanisms. To be able to correlate the stereo chemical structures of the reactants and products.

Course Description

Methods of determining a reaction mechanism, recognize and interpret the mechanisms of some common organic reactions from kinetic data, stereo chemical data, isotope labeling, kinetic isotope, and salt effects, and effects resulting from changes in substituents (electronic effects), reagents or solvents, nucleophilic and electrophonic substitution reaction, elimination and addition reactions and pericyclic reactions, propose the likely nature of the transition state and predict the effect any change of reaction conditions will have on the reaction.

Main text books:

- Guidebook to Mechanism in Organic Chemistry, by peter sykes, 6th ed., Longman.

Subsidiary books:

- J. McMurry, Organic Chemistry, 6th ed.,1992 Belmont, C A.

22	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 343	Experimental Physical Chemistry	-	6	2	Chem 241

Objectives of the course:

The course aims to cover a series of experiments designed to illustrate some common techniques of physical chemistry.

Course Description:

This course is a series of experiments designed to illustrate some common techniques of physical chemistry .

Main text book:

- Experimental Physical Chemistry, F. Daniels et. al., 7th ed., 1970, McGraw-Hill.

Subsidiary book:

- Practical Physical Chemistry, by Findlay, 9th ed.

23	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 344	Chemical Kinetics	3	-	3	241

Objectives of the course:

The course aims to give the students the theoretical background in the kinetic molecular theory of gases, rates and mechanisms of chemical reactions, photochemistry and electrochemistry.

Course Description

Kinetic molecular theory of gases; Kinetics and mechanism of Chemical reactions, rate equations, reactions in solution, photochemistry and electrode reactions, heterogeneous reactions.

Main text book:

- Physical Chemistry, R. Alberty & R. J. Silby, 2nd ed., 1992, John Wiley & Sons.

Subsidiary books:

- Introduction to electrochemistry, D. Bryn Hibbert, 1993.
- Physical Chemistry, J. de Paula & P. Atkins, 7th ed., 2001, W. H. Freeman.

24	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 345	Solid State and Surface Chemistry	2	-	2	Chem. 241

Objectives of the course:

The course aims to give the students the principles in solid state, surface chemistry, colloids and Catalysis.

Course Description

Crystal system- unit cell- X-ray diffraction- cubic crystals- Types of semiconductors- Adsorption of gases- Surface Area-Adsorption from solutions- Homogeneous and heterogeneous Catalysis- Enzyme Catalysis- Colloids; their types , methods of preparations and properties.

Main text book:

- Physical Chemistry, J. de Paula & P. Atkins, 7th ed., 2001, W. H. Freeman.

Subsidiary books:

- Introduction to Surface Chemistry and Catalysis, G. A. Somorjai, 1994, Wiley-Interscience.
- Physical Chemistry, W. Moore and Lands.

25	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem.390	Training I	-	6	2	Approval by the department

Course objective:

This course aims to utilize the scientific skills gained by the student throughout this programme. He trained in one of the applied fields of chemistry in both governmental and private sectors.

Course Description:

The student should conduct training in one of the specific fields of chemistry in laboratory of governmental or private sectors. Experimental reports and lab activities should be written and presented in a seminar. Student work will be evaluated by a certain committee.

26	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem.414	Electroanalytical Methods	2	-	2	Chem.312

Course objective:

The aim of this course is to cover electrochemical methods of analysis which is not given in chem.312.

Course Description:

Potentiometric methods, general principles, direct application and Potentiometric titrations, types of ion selective electrodes and their applications, electrogravimetric methods of analysis, coulometric methods of analysis, conductance and applications.

Main text books:

- Analytical electrochemistry, J.Wang, 3rd ed., 2006, Jon Wiley & Sons
- Analysis with Ion-Selective electrodes, P.Baily, 1976, Heyden.

Subsidiary book:

- Chemical Sensors “An introduction for Scientists and engineers, G. Peter, 2007, 1st ed., Springer.

27	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem.415	Analysis of Industrial Products	2	-	2	Chem.312, Chem 313

Course objective:

The course deals with the chemical analysis of organic and inorganic industrial products such as food, water, medicines and perfumes.

Course Description:

The course provides background on: (1) Integration of aspects of analytical chemistry (2) Explanation of how classical and modern instrumental methods of analysis can be used to solve problems of industrial importance (3) Understanding the nature of matrix before attempting the analysis of analyte(s) of interest within this matrix, (4) To be aware of the possibilities of problems associated with the analysis of industrial samples, (5) minimization/elimination of errors in analysis.

Main text books:

- Analytical Methods for Food Additives, R. wood, L.Foster, A.Damant and P. Key, 2004, CRC Press.
- Analysis, Fate and Removal of Pharmaceuticals in the Water Cycle, M.Petrovic and d.Barcelo, 2007, Elsevier.

Subsidiary book:

- Food Toxicant Analysis: Techniques, Strategies and Developments, Y. Pico, 1st ed. 2007, Elsevier.

28	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem.416	Application of Mass Spectrometry in Anal.Chem	2	-	2	Chem.312, Chem 313

Course objective:

The aim of the course is to give the student recent information regarding mass spectrometer. Its applications in chemical analysis for organic and inorganic compounds.

Course Description:

Introduction to mass spectrometer- Instrument description- types of information- Instruments for organic and inorganic analyses- interferences-Result interpretation- Application of mass spectrometer.

Main text books:

- Inductively Coupled Plasma Spectrometry and Its applications, S.J.Hill, 2nd ed., 2007, Blackwell Publishing Ltd.
- Gas Chromatography and Mass Spectrometry, F.G.Kingston, B.S.Larsen and C.N.MeEwen, 1996, Academic Press.
- Liquid Chromatography Mass Spectrometry: an introduction, r.E.Ardrey, 2003, John Wiley&Sons.

29	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem.417	Special Topics in Analytical Chemistry	2	-	2	Chem.312

Course objective:

The aim of this course is to give a theoretical aspects for some special analytical methods was not included in one of the courses.

Course Description:

Amplification reactions and their uses in chemical analysis methods of elemental analysis- Preparation of different standard solution- evaluation and comparing the different chemical analysis methods.

Main text books:

- Statistics for Analytical Chemistry, J.C.Miller and J.N.Miller, 4th ed., 2000, Prentice Hall.
- Quantitative Chemical Analysis, Daniel c.Harris, 5th ed., 2002, w.H.Freeman.

Subsidiary book:

- Survey of Analytical Chemistry, S. Sigaia, 1968, McGraw-Hill.

30	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 424	Chemical Application of Group Theory	2	-	2	Chem 322

Course objective:

A course designed to give qualitative and semi quantitative treatment of group theory and its applications in chemistry. Particular emphasis will be devoted to vibrational and electronic spectroscopy of inorganic complexes.

Course Description:

Definition and theorems of group theory, molecular symmetry and the symmetry point groups, representations of groups, matrices as representation of symmetry operations, "The great orthogonality theorems", reduction of reducible representations, the direct product, construction of hybrid orbitals for sigma and pi-bonding in AB_N molecules and their molecular orbitals, molecular vibrations, normal mode analysis and determination of Γ_{3N} , infrared and raman spectroscopy, assignments of vibrational spectra, ligand field theory, splitting of levels and terms in a chemical environment, transition from weak to strong crystal field, selection rules for electric-dipole transition, centrosymmetric and non-centrosymmetric complexes.

Main text books:

- Group Theory for Chemists, G. Davidson, 1991, McMillan Press.

Subsidiary books:

- Chemical Application of Group Theory, F. A. Cotton, 3rd ed., 1990 John Wiley and Sons.

31	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 425	Organo-metallic Chemistry	2	-	2	Chem 322

Course objective:

A course intended to give an overall view of organometallic compounds, their syntheses, structure, bonding, and major uses in homogeneous and heterogeneous catalysis.

Course Description

CO molecule, unsaturated carbon chains and rings and the formation of metal-carbon bonds, IUPAC nomenclature, the concept of back-bonding, electro neutrality and the 18-e- rule, σ -bonded complexes (carbonyls, alkyls, hydrides etc...), π -bonded complexes (ferrocenes, alkenes, alkynes, allyles, etc...), stereochemistry and simple MO-bonding, syntheses and reactions of organo-metallic compounds, characterization by i.r., ^1H nmr and ^{13}C nmr., metal nitrosyls and dinitrogen complexes, homogeneous and heterogeneous catalysis, applications in organic syntheses.

Main text books:

- Organometallic Chemistry, G. O. Spessard, G. L. Missler, 1996, Prentice-Hall.

Subsidiary books:

- The Organometallic Chemistry of the Transition Metals, R. H. Crabtree, 3rd ed., 2000, John Wiley & Sons.

32	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 426	Bioinorganic Chemistry	2	-	2	Chem 322

Course objective:

This course is aimed to give the students a chemical background in the role of the elements and their complexes in living organisms. Role of enzymes and coenzymes, macrocyclic chelating ligands. Importance of microelements to living system, medicinal chemistry.

Course description:

This course includes an introduction to bioinorganic chemistry and its relation with other branches of chemistry as well as of other sciences. Role and function of inorganic elements in biological system. Macrocyclic chelate ligands. Nucleobases, nucleotides, and nucleic acid as ligands, dealing with models, corrin, porphyrin, cobalamines, cytochromes, haemoglobin, oxygen carriers, ferredoxins, redox reactions, blue copper proteins, photosynthesis, vitamin B, inhibition and poisoning, essential biological microelements, and medicinal chemistry.

Main text books

- Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life: an introduction, W. Kaim and B. Schwederski, 1994 John Wiley.

Subsidiary books:

- Bioinorganic Chemistry, I. Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine, 1994, Mill Valley.
- Principles of Bioinorganic Chemistry, S. J. Lippard & J. M. Berg, 1994, Mill Valley.

33	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 427	Environmental Inorganic chemistry	2	-	2	Chem 322

Course objective

This course is aimed to give the students an awareness of the sources of inorganic pollutants in air, water and soil; the secondary reactions of these pollutants and methods of clean up.

Course Description

Natural cycles, oxygen, nitrogen, carbon, sulphur cycles and their reactions in the atmosphere. Influence of human activity on the environment, Inner and outer air pollutants, acid rain, particulates, ozone layer, renewable energy. Water pollution; such as organic toxic compound, effect of pesticides. Effect of poisoning heavy metals. Soil pollution; such as organic and inorganic materials, radiation activities, radon. The typical ways to protect environment, keep it healthy and unpolluted.

Main text books:

- Environmental Chemistry, P. O'Neil, 1993, Chapman & Hall.

Subsidiary books:

- Environmental Chemistry, E. Manahan, 1994, Lewis publishers.

34	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 428	Special Topics in Inorganic Chemistry	2	-	2	Chem 322

Course objective

This course aims to introduce recent and important topics to the students in the field of inorganic chemistry which will be specified by the department.

Course Description

The contents of the course described by the department.

35	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 435	Heterocyclic Chemistry.	2	-	2	Chem 334

Course objective:

This course gives the student a detailed study of the chemistry of heterocyclic compounds, containing one or two heteroatom in five and six membered ring compounds, as well as an introduction to the chemistry of natural products.

Course Description:

The first part of the course includes the classification, structure and nomenclature of aromatic five and six membered heterocyclic compounds with one heteroatom and their biologically and pharmacologically active derivatives - saturated and partially saturated heteroacyclic compounds with one heteroatom.

Main text books:

- Heterocyclic Chemistry, J.A.Joule, Keith Mills& G.F. Smith, 2000, Van Nost Reinhold.
- Organic Chemistry, L. Finar, 1988, Longman.

Subsidiary books:

- An introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson., 3rd ed., 1967. Interscience.

36	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 436	Applied Organic Chemistry	2	3	3	Chem 334

Course objective:

The course aims to give the student a comprehensive study about the industrial methods of production of many petrochemicals and some organic compounds with industrial, agricultural and medicinal importance.

Course Description:

The course comprises these chapters:

Production of petrochemicals from natural gas, petroleum products ,thermal cracking, petrochemicals from ethylene, hydrogenation process, alkylation's process, detergents, isomerization process, oxidation of hydrocarbons, , vitamins, chemotherapy, chemistry of additives and flavors, perfumes, pesticides insecticides and pheromones, dyes and colored compounds.

Main text books:

- From Hydrocarbons to Petrochemicals, L. F. Hatch & S. Matar, 1982, Gulf Publishing Company.

37	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 437	Chemistry of natural products	2	3	3	Chem 435

Course objective:

The course aims to give students basic principles of extraction elucidation structure of the natural products from the natural sources.

Course Description:

Classification of natural products, study examples from terpenoids, steroids, alkaloids, fatty acids and amino acids for how to extract, identification, elucidate structure and biogenesis.

Main text books:

- Chemistry of Natural Products, A. M. Dawidar, M. Abdel-Mogib, M. A. Metwally, S. N. Ayyad, 1st ed., 1998.
- Chemistry of natural products, Sujata V. Bhat, Bhimsen A. Nagasampaji, S. Minakshi, Narosa publishing House PVt.Ltd. Reprint 2005.

36	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 438	Chemistry of Synthetic Polymers	2	-	2	Chem 334

Course objective:

This course is aiming to give the student a background on the industrial organic polymers, their structure, properties and the different techniques used for preparation and characterization. Also to give knowledge on the dependence of the physical and chemical properties of polymers on their chemical structure in addition to some application directions in which the polymer play an important role.

Course Description:

Introduction – Definitions - Polymerization processes – Free radical polymerization and their mechanisms – Polymerization initiators – Chain transfer reactions – Polymerization Regulators – Autoinhibition – Polymerization of Dienes – Copolymerization – Cationic polymerization – Anionic polymerization – Anionic initiators – Ring Opening Polymerization – Polymerization techniques – Molecular weight determination – Chemical reactions on polymers – Chemical structure and polymer properties – Science of rubber – Science of Plastic – Science of Fibers.

Main text books:

- Textbook of Polymer Science, Billmeyer, 1990, John Wiley & Sons.

Subsidiary books:

- Principles of Polymerization, Odian, 1994, John Wiley & Sons.
- Polymer Chemistry an Introduction, G. Challa, 1992, Prentice Hall.

39	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 439	Special topics in Organic chemistry	2	-	2	Chem 334

Course objective:

To give the student the theoretical principles of one field in organic chemistry of the following topics, which are in agreement with the department requirements.

- 1- Organic synthesis in aqueous medium.
- 2- Introduction to biotransformation.

Course Description:

Organic synthesis in aqueous medium instead of organic solvents as reaction medium in presence of surfactants- the advantage of water as a reaction medium, some examples of organic reactions carrying out in water- introduction to biotransformation using microorganisms- Technique to perform some organic reactions.

Main text books:

- Organic Synthesis in Water, P. A. Grieco (editor), 1st ed., 1998, Thomson Science.

Subsidiary books:

- An Introduction to Biotransformation in Organic Chemistry, J. Hanson, 1995, W. H. Freeman.
- Organic Synthesis with Oxidative Enzymes, H. L. Holland, 1992, VCH Publication.

40	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 441	Physical Chemistry of Polymers	2	-	2	Chem. 344, Chem. 231

Objectives of the course:

The course aims to give the students the principles of Polymerization kinetics, Physical properties of polymers and macromolecules.

Course Description

Classification and properties of Polymers- polymer kinetics- Polymeric solutions and criteria of polymer solubility, Apparent, Mechanism and Thermal properties- Molecular weight measurements , analysis and test of polymers

Main text books:

- Text book of Polymer Science, F. W. Billmeyer, 3rd ed., 1990, John Wiley & Sons.

Subsidiary books:

- Principles of Polymerization, 3rd ed., 1991, John Wiley & Sons.
- Polymer Chemistry an Introduction, G. Challa, 1993, Ellis.
- Principles of Polymer Chemistry, Flory, 1967, Cornell University.

41	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 442	Fundamentals of Molecular Spectroscopy	2	-	2	Chem.242

Course objective:

The course aims to give the students the principles of molecular spectroscopy.

Course Description

Characterization of electromagnetic radiation- The quantization of energy- regions of spectra- representation of spectra- Signal-to-Noise- The width and Intensity of spectral transition- Rotational spectra of diatomic molecule- Rotational spectra of polyatomic molecules- The vibration spectra of diatomic molecules- The diatomic vibrating-rotator- The vibration of polyatomic molecules- Electronic spectra of diatomic molecules- electronic spectra of polyatomic molecules.

Main text books:

- Fundamental of Molecular Spectroscopy, C. N. Banwell, 4th ed., 1995, McGraw-Hill.

Subsidiary books:

- Quantum Chemistry, by McQuarrie & Donald, 1997, University Science Books.

42	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 443	Nuclear and Radiochemistry	2	-	2	241

Objectives of the course:

The course aims to give the students the principles of Nuclear and radiochemistry

Course Description:

Historical background, forces in nature, nuclides, Types of radioactive decay, natural decay series, nuclear models, nuclear properties, Mass energy relationships, nuclear reactions, rates of radioactive decay, interaction of radiation with matter, Instrumentation, Introduction to health - physical applications in nuclear and radiochemistry.

Main text books:

- Radiochemistry and Nuclear Chemistry, Jan Rydberg, Jan-Olov Liljenzin, Gregory Choppin, 3rd ed., 2001.

Subsidiary books:

- Radiochemistry and Nuclear methods of analysis, W.Ehmann & D.Vance, 1993.
- Nuclear and radiochemistry, Friedlander et al. 1981.

43	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 444	Photochemistry	2	-	2	344

Objectives of the course:

The course aims to give the students the principles of photochemistry.

Course Description

Basic principles of photochemistry, The Laws of Photochemistry, Lambert Beer's Law , fluorescence, phosphorescence, Physical basis of Molecular Luminescence , Quantum yields, and Photochemical Reaction .Experimental methods in photochemistry. Photochemical Reactions and Their Kinetics. Techniques and applications of photochemistry,

Main text books:

- Principles and Applications of Photochemistry, R. P. Wayne, 1988, Oxford.

Subsidiary books:

- Photochemistry; C. E. Wayne & R. P. Wayne, 1996, OUP primer.
- Essentials of Molecular Photochemistry, A. Gilbert & J. Baggott.
- Modern Molecular Photochemistry, 1991, University Science Books.

44	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 445	Catalysis	2	-	2	345

Objectives of the course:

The course aims to give the students the principles of Catalysis.

Course Description:

Introduction - Homogeneous Catalysis - Heterogeneous Catalysis - Thermodynamics and energetic; Kinetics of heterogeneous Catalysis – Adsorption- Metal Catalysis and trends in the periodic table- Taylor's theory of active centers - Multiplet theory of catalysis - Methods of studying catalysis - Catalysis for industrial processes - Enzyme Catalysis .

Main text books:

- Introduction to Surface Chemistry and Catalysis, G.A.Somorjai, 1994, Wiley-InterScience.

Subsidiary books:

- Heterogeneous Catalysis in Industrial Practice; C. N. Satterfield, 1991, McGraw-Hill.
- Catalysis at Surfaces, J. M. Cambell, 1988.
- Heterogeneous Catalysis Principals and Applications, G. C. Bond, 1987, Oxford.

45	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 446	Electrochemistry	2	-	2	Chem. 344

Objectives of the course:

The course aims to give the students the principles of Electrochemistry.

Course Description:

Introduction, Potentials and thermodynamics of cells, Electric double layer and adsorption on electrode surface, Mechanism of electrode reactions and mass transport, Kinetics of electrical processes, Techniques for measurements based on potential and current control, Applications of electrochemistry, Metallic corrosion and protection of metals.

Main text books:

- Electrochemistry Principles, Methods and applications, C. M. A. Brett and A. M. O. Brett, 1993, New York.

Subsidiary books:

- Electrochemical methods: Fundamentals and Applications, Allen J. Bard, 2001, John Wiley
- Other Books covering the subject.

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46	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 490	Training II	-	6	2	Approval by the department

Course objective:

This course tends to train the student in conducting a research work and provides an opportunity for the acquisition of skills by practical work.

47	Course No.	Course Title	No. of Units			Pre-requisites
			Th.	Pr.	Credit	
	Chem 491	Research Project	-	9	3	Chem 312, 323, 334, 343

Course objective:

This course aims to the training of the student on the principles of scientific research, collecting the data, presenting and concluding the results. The student carry some practical experiments in one of the selected subject by the chemistry department then write a report about the selected issue, contains the principles and results obtained.