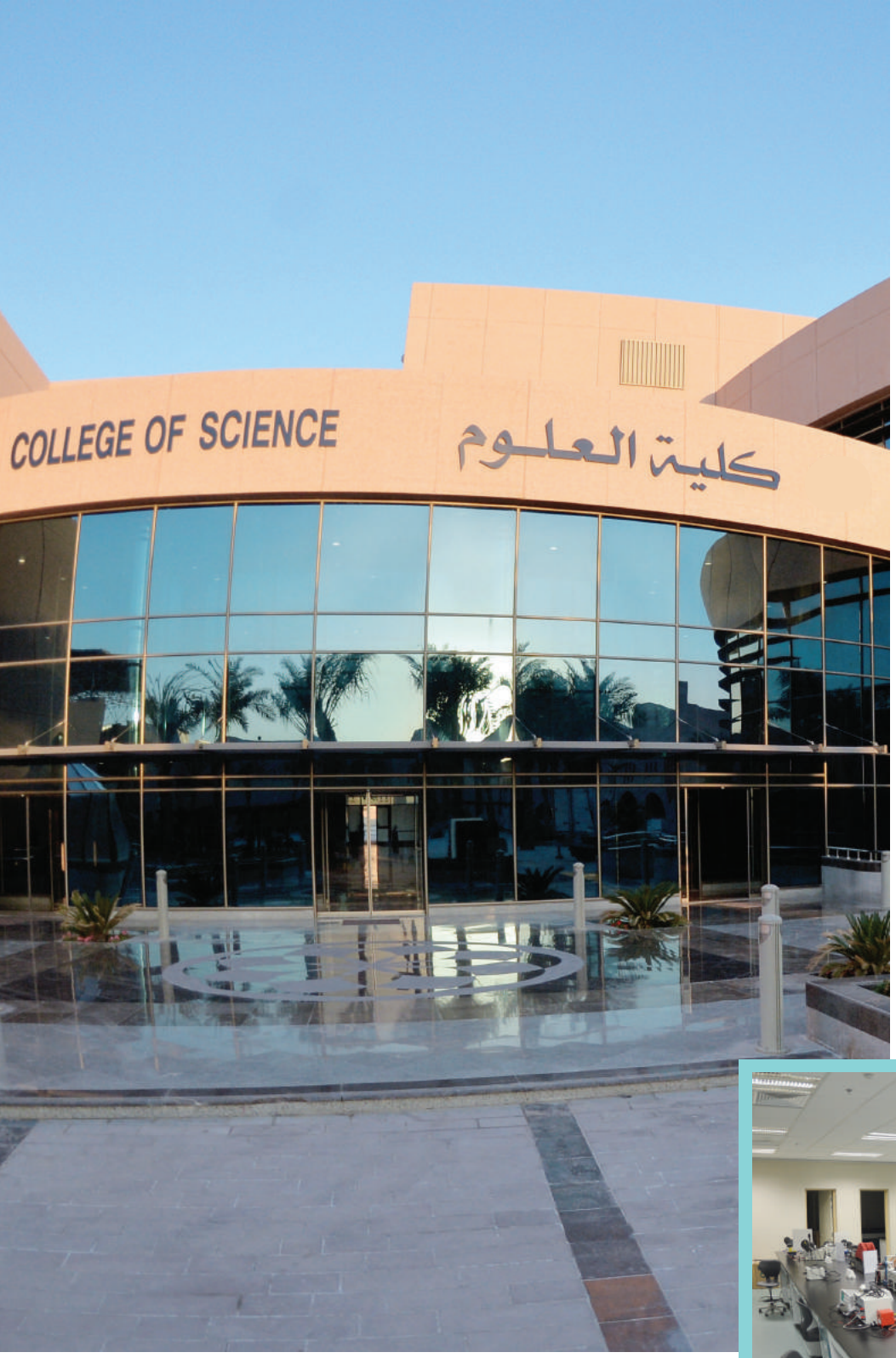

KING FAISAL UNIVERSITY
COLLEGE OF SCIENCE
MATHEMATICS AND
STATISTICS DEPARTMENT

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Course Name	General Chemistry 1				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem101	0825101	1	3	-
Course Track	☐University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The course is designed to provide fundamental principles and laws of general chemistry, including properties and transformations of matter; atomic and molecular structure; atomic theory; chemical reactions; solutions, chemical calculations; periodic classification of the elements; chemical bonding and geometry; electron configuration of atoms; hybridization of atomic orbital; molecular orbital theory; properties of gases, liquids and solids and intermolecular forces.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize basic knowledge in general chemistry such as atomic structure, chemical reactions, periodic table, properties of elements and molecular orbitals.
2. Memorize the type and characteristics of basic chemical reactions (Acid-Base reactions, precipitation, redox reactions)
3. Develop a critical thinking in all physical and chemical aspects of this course.
4. Perform mathematical calculations related to chemistry (number of moles, molarity, Stoichiometric calculations, limiting reagent….)
5. Apraise interactive connection with internet and web-based references for extracting information.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	R. H. Petrucci, F. G. Herring, J. D. Madura and C. Bissonnette. General Chemistry Principle and Modern Application. Pearson. 11th edition, (2016).							
Reference	R. Chang and J. Overby. Chemistry. McGraw-Hill Education. 13th edition, (2018).							

Course Name	General Chemistry 1 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem111	0825111	1	1	-
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The course includes selected experiments in General Chemistry 1 including; measurements of mass, volume and densities, chemical reaction and stoichiometry, identification of acid and base radicals, identification of salt compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize principals of laboratory safety.
2. Memorize the knowledge of basic concepts in experimental general chemistry.
3. Learn basic measurements such as mass, volume, mass, density and temperature.
4. Learn how to write a report in a proper manner.
5. Interpret conclusions and consequences from experimental data.
6. Identify acid and basic radicals from experimental data.
7. Demonstrate the ability to interact with other students and engage in team -works.
8. Appraise interactive connection with internet and web-based references for extracting information.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	D. Ebbing and S. D. Gammon. Lab Manuel Experiments in General Chemistry. Cengage Learning. 11th edition, (2016).							
Reference	S.T. Marcus, M. J. Sienko and R. A. Plane. Experimental General Chemistry. McGraw-Hill. 6th edition, (1984).							

Course Name	General Chemistry 2				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem201	0825201	3	3	General Chemistry 1 (0825101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course introduces students to different topics in the field of physical chemistry such as properties of gases, properties of solutions, thermochemistry and kinetics of chemical reactions, chemical equilibrium, introduction to thermodynamic, solubility and ion equilibria.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize different concepts in general chemistry such as, thermodynamic, thermochemistry and kinetics.
2. Interpret basic problems in general chemistry (ideal gases, thermodynamic data, kinetic data, equilibrium, etc)
3. Perform mathematical calculations related to chemistry (Pressure of gases, rate constants, equilibrium constants, thermodynamic parameters….)
4. Appraise interactive connection with internet and web-based references for extracting information.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	R. H. Petrucci, F. G. Herring, J. D. Madura and C. Bissonnette. General Chemistry Principle and Modern Application. Pearson. 11th edition, (2016).							
Reference	S. S. Zumdahl and S. A. Zumdahl. Chemistry. Houghton Mifflin. 7th edition, (2009).							

Course Name	General Chemistry 2 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem211	0825211	3	1	General Chemistry 1 Lab (0825111)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers laboratory aspects of the fundamental principles and laws of chemistry. Topics include ideal gas equation; pneumatic trough; freezing point depression; boiling point elevation, distillation of mixture of volatile liquids, calorimetry and heat of reactions and chemical kinetics.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize different concepts in experimental General chemistry 2, such as ideal gases, thermochemistry and kinetic of reactions.
2. Recall laboratory experiment safely.
3. Interpret conclusions and consequences from experimental data (freezing point, boiling point, Raoult's law, equilibrium …..).
4. Develop a critical thinking in all physical and chemical aspects in the experiments.
5. Demonstrate the ability to interact with other students and engage in team -works.
6. Appraise interactive connection with internet and web-based references for extracting information.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	D. Ebbing and S. D. Gammon. Lab Manuel Experiments in General Chemistry. Cengage Learning. 11th edition, (2016).							
Reference	S.T. Marcus, M. J. Sienko and R. A. Plane. Experimental General Chemistry. McGraw-Hill. 6th edition, (1984).							

Course Name	Organic Chemistry 1				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem202	0825202	3	3	General Chemistry 1 (0825101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The following topics will be covered during this course:
Fundamentals of organic chemistry; molecular structure, properties and reactivity of organic molecules; organic functional groups; fundamental reactions of organic chemistry; study of different classes of aliphatic compounds, their nomenclatures, physical properties, preparations, reactions, reaction mechanism, stereochemistry, and common uses; detailed coverage of hydrocarbons, cyclic compounds, alkyl halides, alcohols, ethers, epoxides, aldehydes and ketones; carboxylic acids and their derivatives, amines and sulphur compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the basic vocabulary of Organic Chemistry.
2. Recognize the synthesis and identification of different classes of organic compounds.
3. Explain the organic molecules in different ways (condensed form, linear form and structural formula).
4. Differentiate among the types of isomerism (geometrical, structural, stereo, etc…).
5. Explain the fundamental relationship between structure (functional groups) and both properties and reactivity within organic molecules.
6. Demonstrate information technology skills, including word processing, database use, archiving data and information retrieval through online computer searches and internet communication.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	50%	**Others**	-		
Textbook	J. McMurry. Organic Chemistry. Brooks/Cole. 9th edition, (2016).							
Reference	P. Y. Bruice. Organic Chemistry. Prentice Hall. 7th edition, (2015).							

Course Name	Organic Chemistry 1 Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem212	0825212	3	1	General Chemistry 1 Lab (0825111)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Selected experiments in Organic Chemistry 1 including purification of organic liquids and solids (distillation, crystallization and re-crystallization); measurements of melting points and boiling points; assignee test & characterization of the different classes of organic functional groups; Characterization of hydrocarbons (saturated and unsaturated); Characterization and identification of alkyl halides, alcohols, phenols, aldehydes, ketones, carboxylic acids, amides and amines.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the basic vocabulary of Organic Chemistry.
2. Recognize the synthesis, characterization and identification of different classes of organic compounds.
3. Differentiate among the types of isomerism (geometrical, structural, stereo, etc…).
4. Explain the fundamental relationship between structure (functional groups) and both properties and reactivity within organic molecules.
5. Demonstrate competence in the use of various procedures for the synthesis and characterization of different classes of organic compound.
6. Demonstrate information technology skills, including word-processing, database use, and internet communication.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	50%	**Project**	-
	Midterm	20%	**Final**	30%	**Others**	-		
Textbook	J. R. Mohrig, D. Alberg, G. Hofmeister, P. F. Schatz and C, N. Hammond Laboratory Techniques in Organic Chemistry. W.H. Freeman and Company. 4th edition, (2014).							
Reference	John C. Gilbert and Stephen F. Experimental Organic Chemistry, A Miniscale and Microscale Approach. Martin, Brooks/Cole. 5th edition, (2011).							

Course Name	Analytical Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem203	0825203	3	3	General Chemistry 1 (0825101)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course first offers an introduction to sampling, error and statistical analysis as applied to analytical chemistry. Specific analytical techniques or concepts covering this course include basic statistics, acid-base equilibria, associated techniques (volumetric analysis, gravimetry) and complex formation. Following a theoretical introduction and background information, a wide range of applications are discussed, as problem sets to be solved mathematically. This course is intended to build the foundation of good analytical laboratory practice.

Course Outcomes

After the completion of this course, the student will be able to:

1. Explain the principles of volumetric and gravimetric analysis.
2. Recognize the application of chemical equilibria to acid/base precipitation, complexometric, and redox titrations.
3. Explain titration curves based on various titration methods.
4. Predict the suitable indicator for a given titration.
5. Interpret problems regarding Stoichiometric calculations involving various concentration units and their interconversions.
6. Search library engines and some open (free) access websites for analytical chemistry problems.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	G. D. Christian. Analytical Chemistry. John Wiley and Sons. 7th edition, (2013).							
Reference	D. Harris. Quantitative chemical analysis. W.H. Freeman Co. 9th edition, (2015).							

Course Name	Analytical Chemistry Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem213	0825213	3	1	General Chemistry 1 Lab (0825111)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers gravimetric and volumetric techniques; evaluation of analytical data; methods and theories of different types of titration including, neutralization, precipitation and complex metric titrations; redox titration; solvent extraction; application of gravimetric analysis and factors affecting it. The course will develop statistical tools of estimation, confidence, accuracy, and precision in treating experimental data.

Course Outcomes

After the completion of this course, the student will be able to:

1. Determine the unknown concentration of sample analytes with accuracy and high precision.
2. Apply the volumetric and gravimetric calculations.
4. Execute effective mathematical calculations necessary to achieve correct values in quantitative analysis.
5. Explain the choose of suitable indicator.
6. Work as a team collaboratively and productively in the lab.
7. Use of multimedia resources and solve particular problems.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Report	-		
Textbook	B. M. Ham and A. MaHam. Analytical Chemistry: A Chemist and Laboratory Technician's Toolkit. John Wiley & Sons. 1st edition, (2016).							
Reference	B. Staniskiene and I. Sinkeviciene. Analytical Chemistry Laboratory Manual. Kaunas. (2012).							

Course Name	Applications of Computer in Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem214	0825214	3	1	Introduction to Computer Sciences Lab (0827112)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Microsoft Excel software, including its concepts and definitions of some statistical parameters (mean, median, standard deviation, relative standard deviation, t-test, F-test, Q-test and confidence limits), calibration curve plotting and uses; Chemistry Drawing programs (Chemsketch 2015v & Accelrys Draw 4.2); Chemistry 3D Drawing programs (3D Viewer 2015v); Virtual laboratory programs, Chemical reactions simulation, (Crocodile Chemistry); Electronic Libraries (KFU Online Library and Saudi Digital Library, SDL) and Scientific Search Engines (Scopus, Google Scholar and SDBS online database).

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the sources of errors in analytical chemistry and the ways to express them (accuracy, Precision, Significant figures…)
2. Learn how to validate new analytical methods by calculating the precision, accuracy, limit of detection and limit of quantification.
3. Recognize how to handle chemistry programs and the main features of them.
4. Handle scientific search engines (Journals, database, catalogues…..)
5. Differentiate between different types of errors in chemical measurements.
6. Discuss databases related to chemistry programs and information webs.
7. Use different programs for drawing chemical compounds and determination of chemical and physical properties.
8. Use internet resources (web and database searches) to find out relevant methods for solving of given Chemical problems.

Assessment Policy								
	Assignment	10%	**Quiz**	20%	**Lab**	-	**Project**	-
	Midterms	20%	**Final**	50%	**Others**	-		
Textbook	James Miller, Jane. C. Miller and Robert. D. Miller. Statistics and Chemometrics for Analytical Chemistry. Paperback. 7th edition, (2018).							
Reference	Chemometrics: Applications of mathematics and statistics to laboratory systems, R. G. Brereton, Ellis Horwood, Chichester. (1990).							

Course Name	Physical Chemistry 1				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem205	0825205	4	3	General Chemistry 2 (0825201)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course includes the following topics: Chemical Thermodynamics; terminology and definitions of basics of chemical thermodynamics, different types of works, Zero, First, Second and Third law of thermodynamics. Entropy and free energy changes in chemical reactions and phase changes. Phase Equilibria of different systems. Reversible electrochemical systems, types of electrodes and types of electrochemical cells and thermodynamic relations in electrochemistry.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the principles of chemical thermodynamics in various chemical systems (laws of thermodynamic, enthalpy, entropy and free energy, phase rules, electrochemistry…)
2. Explain different phenomena in thermodynamic chemistry.
3. Analyze problems in electrochemical systems and phase equilibria.
4. Write individual report.
5. Appraise interactive connection with internet and web-based references for extracting information.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	P. Atkins, J. D. Paula and J. Keeler. Atkins' Physical Chemistry. OUP Oxford. 11th edition, (2017).							
Reference	K. J. Laidler, J. H. Meiser, and B. C. Sanctuary. Physical Chemistry. Houghton Mifflin Co. 4th edition, (2003).							

Course Name	Physical Chemistry 1 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem215	0825215	4	1	General Chemistry 2 Lab (0825211)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides experiments and training in physical chemistry laboratory techniques including: Solubility and dissolution rate, calorimetry, determination of equilibrium constant and change in free energy, measuring enthalpy change, two component system, three component system and four component system.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define basics of experimental design in physical chemistry (thermodynamic rules, calorimetry, solubility, phase rules, etc).
2. Develop practical skills in using the modern laboratory techniques in physical chemistry.
3. Discuss different experimental results in physical chemistry
4. Demonstrate the ability to interact with colleagues and to be involved in team-working.
5. Appraise the use of IT (Power Point Presentation, Web-CT, Search engines, Science Direct).

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	C. W. Garland, J. W. Nibler, and D. P. Shoemaker. Experiments in Physical Chemistry, McGraw-Hill. 8th edition, (2008).							
Reference	J. B. Firth. Practical Physical Chemistry. Kite Press. (2015).							

Course Name	Organic Chemistry 2				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem206	0825206	4	3	Organic Chemistry 1 (0825202)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The following topics will be covered during this course:
Introduction to aromatic chemistry, aromaticity and Huckel's role, reactions of aromatic compounds, mechanism of electrophilic substitution reaction, A study of different classes of aromatic compounds, their nomenclatures, physical properties, preparations, reactions, reactions mechanism, stereochemistry and common uses. Detailed coverage of alkylbenzene, halobenzene, nitrobenzene, aromatic amines, phenols, aromatic, aldehydes and ketones, aromatic carboxylic acids and their derivatives. Aromatic sulphonic acids and polycyclic aromatic compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define aromaticity.
2. Recognize the physical properties of aromatic compounds
3. Explain different types of organic reaction mechanisms.
4. Predict the major product in organic reaction from given starting reagents.
5. Analyze the nature of the reagent and characteristics of common functional groups to explain the reaction.
6. Develop teamwork and cooperation competency.
7. Deal with the library and internet research.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	J. McMurry. Organic Chemistry. Brooks/Cole. 9th edition, (2016).							
Reference	P. Y. Bruice. Organic Chemistry. Prentice Hall. 7th edition, (2015).							

Course Name	Organic Chemistry 2 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem216	0825216	4	1	Organic Chemistry 1 Lab (0825212)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course includes basic techniques and procedures such as isolation, purification, and characterization of organic compounds, identification of organic compounds, separation of mixtures of organic compounds, carrying out of basic organic reactions.

Course Outcomes

After the completion of this course, the student will be able to:

1. List different techniques used in organic chemistry labs.
2. Recognize the basic techniques of isolation of organic compounds
3. Predict a method for purification and characterization of organic compounds
4. Asses the relationship between the structure of an organic compound and its properties.
5. Work in a team collaboratively and productively in the lab.
6. Use of multimedia resources to solve particular problems.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	J. R. Mohrig, D. Alberg, G. Hofmeister, P. F. Schatz and C, N. Hammond. Laboratory Techniques in Organic Chemistry. W.H. Freeman and Company. 4th edition, (2014).							
Reference	John C. Gilbert and Stephen F. Experimental Organic Chemistry, A Miniscale and Microscale Approach. Martin, Brooks/Cole. 5th edition, (2011).							

Course Name	Biochemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem207	0825207	4	3	Organic Chemistry 1 (0825202)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course explores the basic principles of biochemistry by providing molecular composition and understanding of living cells. It includes the following topics: Structure, synthesis, configuration and function of biological molecules (carbohydrates, proteins, lipids, and nucleic acids), enzymology, special properties of biological membranes, hormones, vitamins and metabolic pathways.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the principles and purposes of biochemical processes and different biological structures.
2. Explain the structures and the functions of biomolecular compounds that exist in both eukaryotic and prokaryotic cells.
3. Calculate the numbers of isomers of different carbohydrate structures.
4. Evaluate the unknown bimolecular structure from well-organized chart created for this issue.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	V. W. Rodwell, D. Bender and K. M. Botham. Harper's Illustrated Biochemistry. McGraw-Hill Education. 31st edition, (2018).							
References	D. L. Nelson and M. M. Cox. Lehninger Principles of Biochemistry. W.H. Freeman. 7th edition, (2017).							

<table>
<tr><td>Course Name</td><td colspan="3">Biochemistry Lab</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Chem217</td><td>0825217</td><td>4</td><td>1</td><td colspan="2">Organic Chemistry 1 Lab (0825212)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="7">Course Description
This course aims to introduce some of the most widely used experimental procedures in biochemistry, including qualitative determination and quantitative estimation of the major biological molecules (carbohydrates, lipids, proteins and amino acids) as well as enzyme assays and kinetics.</td></tr>
<tr><td colspan="7">Course Outcomes
By the end of the course it is expected that the student will be able to:
1- Memorize a deeper understanding of biochemistry through the application of various practical approaches.
2- Recognize principles of key laboratory methods in biochemistry.
3- Develop experience in problem solving.
4- Critically analyze experimental data.
5- Work as a member of a team in a biochemical lab.
6- Use of multimedia resources to solve particular problems.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>-</td><td>Lab</td><td>50%</td><td rowspan="2">Project</td><td rowspan="2">-</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>30%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="6">A. Hofmann and S. Clokie. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. 8th edition, (2018).</td></tr>
<tr><td>Reference</td><td colspan="6">Y. M. Shivaraja Shankara, M. K. Ganesh, A. R. Shivashankara. Laboratory Manual for Practical Biochemistry. Jaypee Brothers Medical Publishers. 2nd edition, (2013).</td></tr>
</table>

Course Name	Inorganic Chemistry 1				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem208	0825208	4	3	General Chemistry 1 (0825101)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following topics: 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.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the properties of the elements and the reactions they undergo to form compounds.
2. Describe electronic structure of atoms and molecules including types of bonds in inorganic chemical compounds.
3. Explain the chemistry of main group elements.
4. Illustrate an independent learning.
5. Assess interactive connection with internet and web-based references for getting information.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	G. L. Missler, P. J. Fischer and D. A. Tarr. Inorganic Chemistry. Pearson. 5th edition, (2014).							
Reference	1. F.A. Cotton, G. Wilkinson and P.L. Gauss. Basic Inorganic Chemistry. Wiley & Sons. 6th edition, (2009). 2. A.G. Sharpe. Inorganic Chemistry. Longman Scientific and Technical. (1992).							

Course Name	Physical Chemistry 2				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem301	0825301	5	3	Physical Chemistry 1 (0825205) Calculus 1 (0827101)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course includes the following topics: Rate law and order of the chemical reactions, Zero, First, Second and Third- order chemical reactions, Determination of the rate laws and mechanism of the chemical reaction. Kinetics of complex reactions, Dynamic electrochemical systems: Electrochemical kinetics, Polarization and irreversible electrochemical systems and its applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basics of chemical kinetics and different orders.
2. Recognize the different types of polarizations.
3. Justify the best method to follow up the kinetic and mechanism of different chemical reactions.
4. Interpret kinetic parameters and electrochemical data.
5. Analyze polarization curves.
6. Exchange ideas between students related to kinetic.
7. Simulate unknown kinetic step of reaction.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	P. Atkins, J. D. Paula and J. Keeler. Atkins' Physical Chemistry. OUP Oxford, 11th edition, (2017).							
Reference	K. J. Laidler, J. H. Meiser, and B. C. Sanctuary. Physical Chemistry. Houghton Mifflin Co. 4th edition, (2003).							

Course Name	Physical Chemistry 2 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem311	0825311	5	1	Physical Chemistry 1 Lab (0825215)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course provides experiments and training related to kinetic of reactions including:
Kinetic studies of zero, first and second order reactions, effect of ionic strength on kinetic of chemical reactions, activation energy of chemical reactions, study of the kinetic of saponification reaction using conductometry, study of the kinetic of sucrose conversion using polarimetry, study of the iodination of cyclohexanone by spectroscopic methods and finally determination of the order of a given reaction.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize experimental design in kinetic chemistry
2. Memorize experimentally different methods to determine the order of a chemical reaction
3. Develop practical skills in using laboratory techniques to study the kinetic of chemical reactions.
4. Interpret different data to determine kinetic parameters such as the order of a chemical reaction and the activation energy.
5. Demonstrate the ability to interact with colleagues and to be involved in team-working.
6. Appraise the use of IT (Power Point Presentation, Web-CT, Search engines, Science Direct).

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	C. W. Garland, J. W. Nibler, and D. P. Shoemaker. Experiments in Physical Chemistry McGraw-Hill. 8th edition, (2008).							
Reference	J. B. Firth. Practical Physical Chemistry. Kite Press. (2015).							

Course Name	Organic Reaction Mechanisms				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem302	0825302	5	3	Organic chemistry 2 (0825202)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course aims to cover the following topics in organic reaction mechanisms including: Chemical bonding and structure; stereochemical principles; conformational and steric effects; methods of mechanistic study; conformational, steric and stereo-electronic effects; bonding; isomerism, stereochemistry and properties of organic compounds; acids and bases; nucleophilic substitution reactions; electrophilic addition to alkenes; elimination reactions; nucleophilic addition; introduction to free radical reactions, and rearrangements reactions.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the main organic reaction Mechanisms.
2. Predict the reactivity and stability of organic compounds from their structures.
3. Describe a reasonable mechanism for a chemical reaction.
4. Explain substituent effects.
5. Demonstrate the ability to work in a team.
6. Research information with electronic devices.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	M. B. Smith. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure. Wiley. 7th edition, (2013).							
Reference	J. Clayden, N. Greeves and S. Warren. Organic Chemistry. OUP Oxford. 2nd edition, (2012).							

Course Name	Instrumental Analysis 1				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem303	0825303	5	3	Analytical Chemistry (0825203)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course is designed to explore basic instrumental methods of analysis that are common in quality control processes. It includes distribution of frequencies in the electromagnetic spectrum. Molecular and atomic spectroscopy. Electronic, vibrational and rotational transition and spectra. Emission and absorption spectra. Visible and UV spectrophotometry. Spectroscopic instrument components: light source, monochromator, detector, single and double beam spectrophotometers. Lambert-Beer law. Calibration methods in instrumental analysis/regression and correlation. Atomic absorption spectrophotometry, Emission spectrophotometry, X-Ray Spectroscopy and X-Ray Diffraction.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basis of spectroscopic methods of analysis.
2. Describe the basic components of various spectroscopic instruments.
3. Predict proper instrumental analysis method for specific tasks.
4. Show the difference between various spectrophotometric techniques.
5. Illustrate the application of different types of spectroscopy for sample identification and quantification.
6. Appraise the use of internet resources (web and database searches) to find out relevant methods for the analysis of a given sample.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	J. W. Robinson, E. S. Frame and G. M. Frame II. Undergraduate Instrumental Analysis. CRC press. 7th edition, (2014).							
Reference	D.A. Skoog, D.M. West, F.J. Holler and S. R. Crouch. Fundamentals of Analytical Chemistry. Cengage Learning. 9th edition, (2014).							

Course Name	Instrumental Analysis 1 Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem313	0825313	5	1	Analytical Chemistry (0825213)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following topics: Measurement of standard samples and investigation of performance of spectroscopic instruments. Spectrophotometric determination of pka. UV-visible molecular absorption and fluorescence spectroscopy for determination of phenols, quinines and fluorescein. Complex photometric titrations. Colorimetric determination of nitrates and phosphates in soil. Analysis of metal ions in water and soil samples using atomic absorption and emission spectroscopy. FTIR of silicates and graphite, Near IR spectrophotometry for determination of urea and soil organic matter.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe theoretical and experimental concepts used in spectroscopic instruments.
2. Evaluate and apply appropriate theories, principles and concepts relevant to spectroscopic instruments in the laboratory.
3. Design proper method of analysis.
4. Demonstrate the ability to select the right analytical method for the sample to be analyzed.
5. Analyze soil and water samples using ideas and techniques related to spectroscopy.
6. Assess internet resources (web and database searches) to find out relevant methods for the analysis of given samples.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	N. Chen. Practical Undergraduate Instrumental Analysis Laboratory Experiments. Paperback. (2013).							
References	1. Journal of analytical chemistry 2. Journal of applied spectroscopy.							

Course Name	Inorganic Chemistry 2				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem304	0825304	5	3	Inorganic Chemistry 1 (0825208)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following topics: types of ligands; nomenclature of coordination complexes and IUPAC rules; 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 Oh and Td complexes, and Angular overlap model(AOM).

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the deferent theories of bonding of coordination compounds.
2. Memorize chemical and physical properties of coordination compounds.
3. Predict properties of different coordination compounds.
4. Illustrate different types of coordination compounds and their applications.
5. Operate library engines and some open (free) access websites for visualizing coordination chemistry problems.
6. Assess interactive connection with internet and web-based references for getting information.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	G. L. Missler, P. J. Fischer and D. A. Tarr. Inorganic Chemistry. Pearson. 5th edition, (2014).							
References	1. F.A. Cotton, G. Wilkinson and P.L. Gauss. Basic Inorganic Chemistry. Wiley & Sons. 6th edition, (2009). 2. J. E. Huheey, E.A. Keiter and R. L. Keiter. Inorganic Chemistry; Principles of structure and Reactivity. Harper Collins. 4th edition, (1997).							

Course Name	Inorganic Chemistry Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem314	0825314	5	1	
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The laboratory course emphasis the synthesis of inorganic compounds and the study of their physico-chemical properties. Selected experiments in inorganic chemistry including; syntheses and characterization of transition metal salts and complexes; physico-chemical experiments including; magnetic, conductometric, optical methods and others.
Suggested Inorganic laboratory experiments (tentative and subject to change to similar ones).

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the synthesis and characterization techniques related to inorganic chemistry.
2. Explain results and consequences from experimental data related to inorganic chemistry.
3. Perform laboratory experiments that are based on fundamental chemical principles.
4. Write professional reports in a style consistent with currently accepted scientific structure.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	G. S. Girolami, T. B. Rauchfuss and R. J. Angelici. Synthesis and Technique in Inorganic Chemistry: A Laboratory Manual. University Science Books. 3rd edition, (2014).							
Reference	W. L. Jolly. Synthesis and Characterization of Inorganic Compounds. Waveland press. 1st edition, (1991).							

Course Name	Physical Chemistry 3				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem305	0825305	6	3	Physical Chemistry 2 (0825301)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course includes the following topics: Surface tension; adsorption of gases; surface area; adsorption from solutions; homogeneous and heterogeneous catalysis; enzyme catalysis colloidal state and emulsions.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize principles and experimental techniques related to surface chemistry, catalyst, enzyme and solid-state chemistry.
2. Explain different phenomenon according to the basics given in the area of surface tension, adsorption, catalysis, enzymes, and solid-state chemistry.
3. Show the ability to interact with other students and engage in a teamwork.
4. Derive mathematical relations to solve mathematical problems in the course.
5. Use library engines and some open (free) access websites for visualizing chemistry problems.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	P. Atkins, J. D. Paula and J. Keeler. Atkins' Physical Chemistry. OUP Oxford. 11th edition, (2017).							
References	K. W. Kolasinski. Surface Science: Foundations of Catalysis and Nanoscience John Wiley & Sons In. 3rd edition, (2012).							

Course Name	Materials Chemistry				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem306	0825306	6	3	Physical Chemistry 1 (0825205)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course involves the following topics: synthesis of broad scale of materials (such as thin film, fiber, nano and macro sizes of different powders materials); properties and applications; transformation in material nucleation and crystal growth; study of crystal systems; packing in solids; reaction chemistry in solids and material characterization techniques.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize a descriptive overview of Materials Chemistry.
2. Recognize different methods of preparations and characterizations of materials.
3. Recognize the industrial applications of materials.
4. Compare different types and characteristics of materials.
5. Derive mathematical relations to solve mathematical problems in the course.
6. Deal with the library and internet search.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	B. D. Fahlman. Materials Chemistry. Springer. 3rd edition, (2018).							
References	W. D. Callister Jr, D. G. Rethwisch. Materials science and Engineering, An Introduction. Wiley. 9th edition, (2013).							

Course Name	Organic Spectroscopy				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem307	0825307	6	3	Organic Chemistry 2 (0825206)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course aims to cover, the principles and basic scientific knowledge in organic spectroscopy, Characterization of organic compounds by: Electronic Spectroscopy Ultraviolet and visible (UV-Vis) Spectrometry, Infrared (IR) Spectrometry, Nuclear Magnetic Resonance (NMR), Mass Spectrometry (MS), Structural Elucidation of unknown organic compounds using IR , NMR , UV , MS and Elemental analysis.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the importance of the basic concepts of spectroscopy including infrared, UV/visible, NMR and Mass spectroscopy.
2. Interpret a given spectroscopic data in a proper way.
3. Justify correctly the choose of a spectroscopic method and instrument meeting the objectives.
4. Illustrate how to use the spectroscopy in identification of unknown organic compounds.
5. Analyse spectroscopic data and write a report.
6. Assess the reaction of electromagnetic radiation with matter.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40 %	**Others**	-		
Textbook	D. L. Pavia, G. M. Lampman, G. S. Kriz and J. A. Vyvyan. Introduction to spectroscopy. Cengage Learning. 5th edition, (2015).							
Reference	D. H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry. McGrew-Hill Book Company. (2010).							

Course Name	Instrumental Analysis 2				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem308	0825308	6	3	Instrumental Analysis 1 (0825303)
Course Track	☐University Requirement ☐College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course is designed to extend fundamental knowledge of instrumental methods of analysis that students have already obtained in previous course and explore new analytical techniques. It covers Liquid-liquid extraction; Principle of chromatography; Gas chromatography; High performance liquid chromatography; Thin layer chromatography; Ion Chromatography; Size exclusion chromatography. Introduction to electroanalytical chemistry; Potentiometry: Ion selective electrode and Electrolysis: Coulometry and electrogravimetry.

Course Outcomes

After the completion of this course, the student will be able to:

1. Outline the basic components of various chromatographic instruments and electro analytical techniques.
2. Recognize the difference between closely related chromatographic techniques.
3. Develop skills in analytical chemistry laws and rules for problem solving.
4. Develop professional skills in analytical methods used for quantitative analysis.
5. Use proper analytical methods for quantitative analysis of different environmental samples.
6. Show the ability to treat interferences through evaluating the validity of the chromatographic and electro analytical methods in the analysis of target compound in complex matrices.
7. Demonstrate oral communication skills.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterms	25%	**Final**	40%	**Others**	-		
Textbook	D.A. Skoog, F.J. Holler and, S. R. Crouch. Principles of Instrumental Analysis. Cengage Learning. 7th edition, (2017).							
References	1. G. D. Christian. Analytical Chemistry. John Wiley and Sons. 7th edition, (2013). 2. J. W. Robinson, E. S. Frame and G. M. Frame II. Undergraduate Instrumental Analysis. CRC press. 7th edition, (2014).							

Course Name	Instrumental Analysis 2 Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem318	0825318	6	1	Instrumental Analysis 1 Lab (0825313)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The student will be exposed to several types of chromatographic techniques and electroanalytical instruments. The course covers the following: Investigation of performance characteristics of chromatographic and electro-analytical instrument in addition to making measurement. Instruments used in experiments are GC, HPLC, ion selective electrodes, and potentiostat. Standards preparation in order to quantify the concentration of samples.

Course Outcomes

After the completion of this course, the student will be able to:

1. Outline the basic components of various chromatographic instruments and electro analytical techniques.
2. Recognize the difference between closely related chromatographic techniques.
3. Develop lab skills in analytical chemistry laws and rules for problem solving.
4. Develop lab skills in analytical methods used for quantitative analysis.
5. Demonstrate in the lab the use of proper analytical methods for quantitative analysis of different environmental samples.
6. Develop of oral communication skills in a group experiment.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab reports**	50%	**Project**	-
	Midterms	20%	**Final**	30%	**Others**	-		
Textbook	N. Chen. Practical Undergraduate Instrumental Analysis Laboratory Experiments. Paperback. (2013).							
Reference	J. W. Robinson, E. S. Frame and G. M. Frame II. Undergraduate Instrumental Analysis. CRC press. 7th edition, (2014).							

Course Name	Organometallic Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem309	0825309	6	3	Inorganic Chemistry 2 (0825304)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course will cover the following topics: organometallic chemistry of the main group elements, and d-block metals; IUPAC nomenclature, the concept of back-bonding, electroneutrality and the 18-e-rule, σ-bonded complexes (carbonyls, alkyls, hydrides etc...), π-bonded complexes (ferrocenes, alkenes, alkynes, allyls, etc...), stereochemistry and simple MO-bonding; organometallic compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Outline the preparation methods of σ and π-bonded complexes.
2. State the structure and bonding in organometallic compounds.
3. Memorize the application of organometallic compounds in organic preparations.
4. Explain the nomenclature of σ-bonded and π-bonded organometallic compounds.
5. Interpret the eighteen-electron rule to the organometallic compounds.
6. Interpret examples of organometallic compounds.
7. Use information and communications technologies.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	G. O. Spessard and G. L. Miessler. Organometallic Chemistry. Oxford University. 3rd edition, (2015).							
Reference	R. H. Crabtree. The Organometallic Chemistry of the Transition Metals. Wiley & sons. 6th edition, (2009).							

Course Name	Quantum chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem401	0825401	7	2	Physical Chemistry 2 (0825301)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description:

The course is an introductory course for quantum chemistry with particular applications to problems of chemical interest and apply it to real life applications such as conjugation, conductivity, tunneling and quantum dots. The solutions to the Schrödinger equation for a number of important model systems will be discussed.

Course Outcomes

After the completion of this course, the student will be able to:

1. Identify quantum chemistry terminology; Quantum hypothesis, Dual nature of matter, energy levels, wave function, eigenvalues.
2. Recognize the concepts of classical mechanics and modern quantum mechanics and apply it to different chemical problems.
3. Explain atoms behavior with radiation to the quantized electronic transitions.
4. Describe precisely the atomic structure, the electronic distribution and the nature of orbitals.
5. Develop critical thinking and analytical problem-solving skills within a quantum chemistry context.
6. Interpret several numerical results.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	D. A. McQuarrie. Quantum Chemistry. Paperback. 2nd edition, (2007).							
Reference	P. W. Atkins, R. Friedman. Molecular Quantum Mechanics. Oxford University Press. 4th edition, (2005).							

Course Name	Polymer Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem402	0825402	7	3	Organic Chemistry 2 (0825206)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following: Nature of polymers, Polymer nomenclature, types of polymers and Source of raw materials for polymers, polymers classification and synthesis. Polymerization processes–Free radical polymerization and their mechanisms, chain transfer reactions, polymerization regulators, autoinhibition, polymerization of dienes, copolymerization, cationic polymerization, anionic polymerization – anionic, initiators, ring opening polymerization, polymerization techniques, chemical reactions on polymers, chemical structure and polymer properties, science of rubber, Science of Plastic, Science of Fibers, Biopolymer, Rubber elasticity, high performance polymers, Vulcanization and cross-linking, importance of, thermoplastic and thermosetting polymers: preparation, properties and uses.

Course Outcomes

After the completion of this course, the student will be able to:

1. Explain the polymerization process.
2. Explain the preparation, properties and uses of polymers
3. Explain the relation between the structure and the properties of polymers.
4. Develop critical and comparative analysis of different polymer systems**.**

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	S. Koltzenburg, M. Maskos and O. Nuyken. Polymer Chemistry, Springer. 1st edition, (2017).							
Reference	A. Ravve. Principles of Polymer Chemistry. Springer. 3rd edition, (2012).							

Course Name	Heterocyclic Chemistry				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem403	0825403	7	2	Organic Chemistry 2 (0825206)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following topics in Heterocyclic Chemistry: Introduction and basic concepts of heterocyclic chemistry, biological and medicinal interests, classification of heterocyclic compounds, study of aromaticity and dipolar resonance, nomenclature systems. Detailed coverage of three, four, five and six membered heterocycles containing one and (two) heteroatom(s) Condensed heterocycles, indole and its related compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the basic concepts of heterocyclic chemistry including chemical structure and aromaticity.
2. Recognize the functional group interconversions and the methods available for carbon-carbon and carbon-heteroatom bond formation.
3. Describe the reaction mechanism of synthesis of some heterocyclic derivatives.
4. Predict the class of heterocyclic organic compound from its name (common & systematic names) and vice versa.
5. Explain the effect of substituents on reactivity and orientation of different classes of heterocycle
6. Demonstrate the ability of searching information individually or in groups.
7. Work effectively in both team and independently on solving problems.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	T. Eicher, S. Hauptmann and A. Speicher. The Chemistry of Heterocycles: Structures, Reactions, Synthesis, and Applications. Wiley-VCH. 3rd edition, (2013).							
References	1. J. A. Joule, K. Mills and G. F. Smith. Heterocyclic Chemistry. Stanley Thornes. 3rd edition, (1998). 2. John A. Joule and Keith Mills. Heterocyclic Chemistry. Wiley-Blackwell. 5th edition, (2010).							

Course Name	Practical Organic Synthesis				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem414	0825414	7	2	Organic Chemistry 2 Lab (825216) Organic Spectroscopy (0825307)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course includes basic concepts of organic synthesis, using the practical skills and basic experimental techniques in organic synthesis, using the modern techniques of the spectroscopic methods (IR, UV and NMR) to identify the synthetic products, oxidation reactions (oxidation of aldehydes), condensation reactions between aromatic aldehydes and aliphatic ketones, reactions of aldehydes or ketones with primary amines (imine formation), acetylation and electrophilic aromatic substitution reactions, azo-dyes, formation of diazonium salts and their uses , esterification (ester synthesis): reactions between carboxylic acids and alcohols in acid medium, natural products (Extraction, Purification, and Identification) , different techniques in chromatography, synthesis and reactions of some heterocyclic compounds, polymers (synthesis of some thermosetting and thermoplastic polymers) and chemistry of soap and detergent.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the basic concepts of functional group chemistry used in synthetic route and the basic concepts in organic dyes and natural products.
2. Recognize methods of purification and identification of synthesized products.
3. Interpret modern laboratory techniques in both organic synthesis and natural products.
4. Analyze the laboratory procedures and results.
5. Interact with other students to engage in team-working, group discussion and solving problems.
6. Use effectively some open access Web sites for visual chemistry (Lectures and Lab).

Assessment Policy								
	Assignment	-	**Quiz**	-	**Lab**	50%	**Project**	-
	Midterm	20%	**Final**	30 %	**Other**	-		
Textbook	J. R. Mohrig, D. Alberg, G. Hofmeister, P. F. Schatz and C. N. Hammond. Laboratory Techniques in Organic Chemistry Fourth Edition. W. H. Freeman. 4th edition, (2014).							
Reference	J. C. Gilbert and S. F. Martin. Experimental Organic Chemistry, A Miniscale and Microscale Approach. Brooks/Cole. 5th edition, (2011).							

Course Name	Inorganic Reaction Mechanisms				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem405	0825405	8	2	Organometallic Chemistry (0825309)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course covers the following topics: Reactivity and reaction mechanisms of coordination compounds. Chemical kinetics. Substitution, Addition, Elimination, and Oxidative-addition reactions., Oxidation-reduction reactions. Metal bonded system. Catalysis.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the different types of inorganic reactions.
2. Recognize all the individual elementary processes involving molecules that take place in producing the overall reaction.
3. Describe the mechanisms for a given inorganic reaction.
4. Interpret physical and chemical aspects accompanying mechanistic paths.
5. Evaluate the validity of any proposed mechanism.
6. Show ability to interact with other students and engage in a team work on topics related to this course.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	J. Atwood. Inorganic and Organometallic Reaction Mechanisms. Wiley-VCH. 2nd edition, (1997).							
Reference	J. Espenson. Chemical Kinetics and Reaction Mechanisms. McGraw-Hill. 2nd edition, (1995).							

Course Name	Corrosion Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem406	0825406	8	2	Physical Chemistry 3 (08252231)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course introduces the fundamentals of corrosion. It covers the following topics: Basics of corrosion science and some corrosion engineering aspects, corrosion of metals, Pourbaix diagrams of different metals, rate of corrosion, chemical and electrochemical Passivation, types of corrosion and corrosion protection, characterization of metals and alloys from corrosion point of view.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define corrosion and list the types of corrosion.
2. Calculate the rate of corrosion.
3. Analyze Pourbaix diagrams.
4. Describe the different protection methods.
5. Interpret different corrosion modes and different practical methods used for corrosion measurements.

Assessment Policy								
	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	E. McCafferty. Introduction to Corrosion Science. Springer. 1st edition, (2010).							
References	1. J. R. Davis. Corrosion: Understanding the Basics. ASM International. (2000). 2. Corrosion Science Journal							

Course Name	Corrosion Chemistry and Surface Chemistry Lab				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem416	0825416	8	1	-
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Design of experiments in electrochemical systems and corrosion. Study of the corrosion of metals and alloys using the weight loss method and polarization techniques. Determination of rate of corrosion and analyzing electrochemical data. Inhibitors and protection of metals and alloys. In addition, students will carry out experiments on the absorption of organic molecules from solutions on solids. Moreover, the determination of critical micelles concentration of surfactants in aqueous solution will be covered.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe a corrosion experiment.
2. Recognize the types of materials from corrosion view.
3. Recognize difference between adsorbate and adsorbent.
4. Design an appropriate inhibitor for a given corrosion process.
5. Estimate amount of an organic adsorbate on a solid adsorbent
6. Choose the best material for low corrosion rates and best inhibitors.
7. Use critical micelle concentration (CMC) of surfactant to tune structure of surfactant in solution.
8. To develop oral communication skills in a group.

Assessment Policy	Assignment	-	Quiz	-	Lab	50%	Project	-
	Midterm	20%	Final	30%	Others	-		
Textbook	H. Kaesche. Corrosion of Metals. Physicochemical Principles and Current Problems. Springer. 1st edition, (2003).							
References	1. J. R. Davis. Corrosion: Understanding the Basics. ASM International. (2000). 2. Corrosion Science Journal 3. E. McCafferty. Introduction to Corrosion Science. Springer. 1st edition, (2010).							

Course Name	Practical Inorganic Synthesis and Characterization				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem417	0825417	8	2	Inorganic Reactions Mechanisms (0825405)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This laboratory course covers the synthesis and characterization of transition metal complexes. Selected complexes are targeted witch have interested structure (supramolecular chemistry) and important applications such as biological activities, and adsorption. Differentiation between isomers of complex. Determination of formation constant of complexes and their reaction rates. The magnetic, conductivity, electrical and optical properties of complexes are measured. The complexes will be characterized by Infrared, UV-visible spectroscopy, XRD magnetism and thermal analysis.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the synthesis and characterization techniques related to inorganic chemistry.
2. explain results and consequences from experimental data related to synthesis and characterization of transition metal complexes.
3. Perform laboratory experiments that are based on synthesis and characterization of transition metal complexes.
4. Write professional reports in a style consistent with currently accepted scientific structure.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	50%	**Project**	-
	Midterm	20%	**Final**	30%	**Others**	-		
Textbook	G. S. Girolami, T. B. Rauchfuss and R. J. Angelici. Synthesis and Technique in Inorganic Chemistry: A Laboratory Manual. University Science Books. 3rd edition, (2014).							
References	Journal of coordination chemistry							

Course Name	Research Project				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem408	0825408	8	2	98 gained credit hours
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The course consists on an individual research work including literature, experimental studies and scientific reports. The student is required to work on a research project under the supervision of an academic staff. The selection of topics is done in consultation with the supervisor. At the end of the course, all students should submit a written research report and prepare an oral presentation to defend the research findings in front of a committee of academic staffs.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize fundamental research skills to address a research question.
2. Recognize different techniques and analyses.
3. Discuss different data in a research plan in an area of interest.
4. Develop practical skills.
5. Contribute to meaning scholarly pursuits (work one to one with faculty member).
6. Sharpen his critical and analytical thinking skills and communications.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	-	**Project**	50%
	Midterm	-	**Final**	-	**Others**	50%		
Textbook	C. Robson. How to do a Research Project: A Guide for Undergraduate Students. Wiley. 2nd edition, (2016).							
Reference	https://scifinder.cas.org							

Course Name	Summer Training				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem399	0825399	6	3	82 gained credit hours
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

An internship during the summer of the third year (after the Sixth level, June to August) where the student has to spend an average of five hours per day (Minimum 200 contact hours during the internship). The training will be done in a professional workplace on projects related to chemistry. The student will have the following tasks: Learn about the project under investigation through literature review; Work on field tasks as assigned by the staff supervisor; Develop a plan for acquiring data and establish a sense of team work; Write the final report on the summer training and submit it to the department; Present and discuss the final report at the beginning of the Fall semester.

Course Outcomes

After the completion of this course, the student will be able to:

1. Have hands on chemical projects and material characterization (polymers, nanomaterials, petrochemicals, energy storage devices or others)
2. Demonstrate the integration of chemistry knowledge in essential industrial needs (Petroleum, petrochemicals, nanomaterials or others).
3. Improve the analytical and technical skills to create a spirit of innovation.
4. Enhance the ability to analyze data and draw conclusions.
5. Develop the skills required in the work environment including leadership responsibilities.
6. Gain new skills in project management and communications.
7. Use computer for analyzing, processing the experimental data.
8. Write reports and present the work during seminars.

Assessment Policy	**Weekly reports**	15%	**Evaluation (Training center)**	35%	**Lab**	-	**Project**	-
	Final Report	35%	**Presentation**	15%	**Others**	-		
Textbook	-							
Reference	-							

Course Name	Photochemistry				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem420	0825420	7	3	Inorganic Chemistry 2 (0825304)
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers the following: Introduction to light and the electromagnetic spectrum, Laws of photochemistry, Terms symbols of electronic states for molecules, Potential energy curves and Frank Condon principle, Jablonski Diagram of Fluorescence, Modes of deactivation of the excited states, Explanation of the absorption and emission spectra, Laser types and Laser safety.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the principle of photochemistry and the rules control the interaction between the light and matter
2. Explain the laws of absorption and emission of light by matter
3. Calculate the energy of light, quantum yield and ratio between particles in ground and excite state.
4. Predict term symbols of the state of levels in ground and excite states of atoms, molecules, complexes and organic compounds.
5. Diagram the relaxation of energy from excited state for the emission spectrum.
6. Demonstrate the photochemistry in life.
7. Illustrate the applications of photochemistry.
8. Evaluate the applications of photochemistry and commutate with the renewable energy.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterms	25%	**Final**	40%	**Others**	-		
Textbook	V. Balzani, P. Ceroni and A. Juris. Photochemistry and Photophysics. Concepts, Research, Applications. Wiley-VCH. 1st edition, (2014).							
References	1. Bergamini, Giacomo and Silvi, Serena. Applied Photochemistry. Springer national Publishing. (2016). 2. M. Persico and G. Granucci. Pohotochemistry, Modern Theoretical Perspective springer International Publishing. (2018).							

Course Name	Environmental Chemistry				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Chem421	0825421	7	3	-
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course introduces the environmental challenges in a chemical perspective. Covered themes include Environmental Systems; Pollution; Hazards; Carbon; Nitrogen; Phosphorus and Sulphur cycles; Discussion of the atmosphere chemistry; Air pollution sources with primary and secondary pollutants; Methods to reduce air pollution impact; Acidic rains; ozone layer depletion; greenhouse effect; Natural composition of soil; soils pollutants such as fertilizers, pesticides, herbicides and pesticides innovative alternatives; Water physicochemical properties; Acidity; Hardness; Water composition, types and qualities; Water pollutants; Steps of physical, chemical and biological treatment; seawater desalination and wastewater treatment methods; Chemical Oxygen Demand; Biological Oxygen Demand; Water analysis.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize basic tools of environmental chemistry.
2. Recognize the difference between primary and secondary pollutants, their types and sources and methods of their analysis.
3. Realize the composition, types and pollutants of water and the steps of physical, chemical and biological treatment, seawater desalination and wastewater treatment.
4. Compare between the environmental systems and their accompanied hazards.
5. Explain the relation between the human, the environment and the energy sources. Demonstrate the photochemistry in life.
6. Propose solutions to some environmental problems from knowledge of environmental chemistry.

Assessment Policy	**Assignment**	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterms	25%	**Final**	40%	**Others**	-		
Textbook	S. Manahan. Environmental Chemistry. Taylor and Francis. 10th edition, (2017).							
References	C. Baird and M. Cann. Environmental Chemistry. W.H. freeman and company. 5th edition, (2012).							

Course Name	Metabolism				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem422	0825422	7	3	Biochemistry (0825207)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course describes the biochemical reactions involved in cellular metabolism of the major biomolecules, carbohydrates, lipids, amino acids, and nucleic acids, with the emphasis on energy production from carbohydrates and lipids. As well, the course highlights the points of regulation and integration of such metabolic pathways.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall the structures of biomolecules involved in the different metabolic pathways.
2. Differentiate between the biochemical anabolic and catabolic pathways and describe the basic chemical transformation in each.
3. Calculate the energy released and energy consumed during catabolic and anabolic pathways, respectively.
4. Explain the important role of the major macronutrients, carbohydrates, proteins and lipids, in cellular metabolism and energy production.
5. Interpret how cellular metabolism is integrated.
6. Work effectively in groups.
7. Improve his/her skills of presentation in front of his/her colleagues.
8. Use information and communications technology.

Assessment Policy								
	Assignment	10 %	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	V. W. Rodwell, D. Bender and K. M. Botham. Harper's Illustrated Biochemistry. McGraw-Hill Education. 31st edition, (2018).							
References	1. D. L. Nelson and M. M. Cox. Lehninger Principles of Biochemistry. W.H. Freeman. 7th edition, (2017). 2. Textbook of Biochemistry with Clinical Correlations, T. M. Devlin. John Wiley and Sons. 7th edition, (2010).							

Course Name	Catalysis				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem423	0825423	7	3	Materials Chemistry 0825306
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

Catalyst fabrication and characterization. Homogenous and Heterogenous catalysis. Catalytic cycles. Examples of important industrial process: Production of inorganic chemicals, Production of Organic Chemicals, Ammonia synthesis, Hydrogenation, Methanol synthesis, Fine Chemicals Manufacture, Petroleum refining and processing, Environmental Catalysis and green chemistry and Electro-catalysis.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the important of catalysts in industry, environment and electrolysis.
2. Describe steps in heterogeneous catalytic reactions.
3. Explain how the heterogeneous catalysis work, deactivated.
4. Analyze the structure of catalysts and their preparation methods.
5. Evaluate the performance and efficiency of the catalysts.
6. Demonstrate skills of solving problems using catalysis technology.
7. Illustrate capability of interactive connection with internet and web-based references for getting information.

Assessment Policy	Assignment	10%	Quiz	25%	Lab	-	Project	-
	Midterm	25%	Final	40%	Others	-		
Textbook	J. Hagen. Industrial Catalysis: practical approach. Wiley-VCH. 3rd edition, (2015).							
Reference	J. Burrington. Industrial Catalysis: Chemistry and Mechanism. Imperial College Press. (2016).							

Course Name	Standard Analytical Methods & Quality Control				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem424	0825424	8	3	Analytical Chemistry (0825203)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers the following: Concept of quality assurance & quality control and its benefits to the manufacturing industries; ISO 9000 Series Quality management. ISO 17025: Competence of testing and calibration laboratories. Standard methods of analysis to comply with quality assurance & control of industrial products. American Society for Testing and Materials (ASTM) selected standard experiments for analysis of water, soil, minerals, cement, concrete, metals in industrial starting materials and products, for compliance with the ISO system.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the concept of quality assurance/quality control and appreciate the needs in chemical and allied industries.
2. Know the various quality standards in cement and steel industries as references for product quality control.
3. Understand the standard methods of chemical analysis in various industries.
4. Criticise quality control of products in chemical and allied industries.
5. Evaluate analytical data for product quality conformance.
6. Illustrate the ability to maintain good laboratory practices.
7. Assess internet resources (web and database searches) to find out relevant quality control methods of industrial products.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	G. W. Latimer. Official Methods of Analysis of Association of Official Analytical Chemists. OAC. 20th edition, (2016).							
Reference	Annual Book of ASTM Standards. (2018).							

Course Name	Bioinorganic Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem425	0825425	8	3	Biochemistry (0825207) Inorganic Chemistry 1 (0825208)
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers the following topics in Bioinorganic Chemistry and that including:
An introduction to bioinorganic chemistry and its relationship with other branches of chemistry as well as other sciences, Role and function of inorganic elements in biological system, Macrocyclic chelate ligands. Nucleobases, nucleotides and nucleic acid as ligands, dealing with models, porphyrin, cobalamines, cytochromes, hemoglobin, oxygen carriers, ferrodoxins, redox reactions, blue copper proteins, photosynthesis, vitamin B, inhibition and poisoning, essential biological microelements and medicinal chemistry.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the role and function of inorganic elements in biological system.
2. Recognize different biological processes involving coordination chemistry, biominerals and enzymes.
3. Explain applications of nanoparticles in Biology, functions of non-redox active elements for proteins or DNA structure.
4. Explain enzyme mechanisms based on Lewis acid activation.
5. Apply coordination chemistry of redox active metals ions.
6. Apply the Marcus theory to explain electron transport in Biology.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	W. Gibbs. Concepts and Applied Principles of Bioinorganic Chemistry. Callisto Reference. Volume III, (2015)							
Reference	W. Kaim, B. Schwederski, A. Klein. Bioinorganic chemistry: Inorganic elements in the chemistry of life: an introduction. Wiley. 2nd edition, (2013).							

Course Name	Introduction to Computational Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem426	0825426	8	3	Quantum Chemistry 0825401
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This introductory course of computational chemistry consists on basic quantum mechanical principles and their applications. During this course, different methods of calculation will be discussed to provide better understanding of the properties of atoms and molecules. The course includes electronic structure theory, geometry optimizations, calculation of ground and excited states, solvent effect, etc. Students will learn how to identify the common computational methods by implementing software packages to perform computer calculations and solve some chemical problems.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the significance of chemical modeling and computational chemistry.
2. Discuss with comparison and visualization of relevant examples.
3. Operate efficiently software packages such as Gaussian XX, GaussView XX and Spartan XX.
4. Evaluate stability of molecules using computational methods.
5. Correctly choose a method and/or a basis set depending on the problem.
6. Demonstrate interpersonal skills to work in a team.

Assessment Policy	Assignment	-	Quiz	10%	Lab	-	Project	25%
	Midterm	25%	Final	40%	Others	-		
Textbook	E. G. Lewars. Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics. Springer. 3rd edition, (2016).							
Reference	D. Young. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems. Wiley-Interscience. 1st edition, (2001).							

Course Name	Nuclear Chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem427	0825427	8	3	Inorganic Chemistry 2 (0825304)
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course will cover the following: Early History of Radioactivity, Radioactive Decay and Growth, Naturally Occurring Radioactive Substances, Artificially Produced Radioactive Substances, Instability of Nuclei, Type of Nuclear Reaction Models and Mechanisms, Half-life times of radioactive materials and Radiochemical applications.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the definitions of Nuclei, Isotopes, radiochemistry and nuclear chemistry of the radioactive elements.
2. Recognize the different types of nuclear radiation and nuclear particles.
3. Explain the types of nuclear reactions.
4. Show ability to interact with other students and engage in team -works.
5. Assess interactive connection with internet and web based references for getting information.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	50%	**Others**	-		
Textbook	J. V. Kratz, K. H. Lieser. Nuclear and Radiochemistry: Fundamenta1s and Applications. Wiley VCH. 3rd edition, (2013).							
Reference	G. Choppin, J. Liljenzin, J. Rydberg, C. Ekberg. Radiochemistry and nuclear chemistry. Academic Press. 4th edition, (2013).							

Course Name	Petroleum chemistry				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem428	0825428	8	3	Organic Chemistry 2 (0825206)
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers the following topics: Introduction about origin of petroleum and natural gas, physical properties and chemical isomerization of petroleum products. Quality measurements and analysis methods of petroleum cuts. Distillation and refining of crude petroleum. Operations and chemical processes. Catalytic reforming, steam reforming, chemical technology process, Natural Gas, Petrochemicals definition – History of Petrochemicals industry. Petrochemical industries (Isobutene, Butadiene). Petrochemicals industries (benzene and xylene derivatives).

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the petroleum origin and the types of petroleum traps and oil recovery methods and distillation.
2. Outline the importance and the use of different petroleum industrial processes.
3. Discuss chemical structures and predict their presence in petroleum distillates.
4. Act ethically and consistently with high molar standards in personal and public forms.
5. Evaluate different crude oil.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	J. G. Speigh. The Chemistry and Technology of Petroleum. CRC Press. 5th edition, (2014).							
Reference	J. G. Speigh, E. Mesini, P. Macini and P. de Alcantara. Petroleum Science and Engineering: Petroleum: Chemistry, Refining, Fuels and Petrochemicals. Paperback. (2014).							

Course Name	Organic Synthesis				
Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	Chem429	0825429	8	3	Organic Chemistry 2 (0825206)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course aims to cover the following topics in organic synthesis and that including:
General aspects of retrosynthetic analysis and disconnection approach, the basic principles that govern the organic synthesis, Explore the fundamental and experimental aspects of organic transformations, apply reactions in the context of catalysis, reactivity, and total synthesis, Predict the reactivity pattern in organic transformations, organic synthesis rules to the synthesis of complex organic molecules, strategies for stereoselective synthesis, including stereo-controlled synthesis of complex acyclic compounds.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the main methods in organic synthesis and to use disconnection approaches methods.
2. Predict multi steps reactions of organic compounds from their structures.
3. Suggest reasonable steps for the synthesis of complex organic compounds with consideration of stereochemistry.
4. Act responsibly in Class.
5. Use electronic devices to get access to the course materials.

Assessment Policy								
	Assignment	10%	**Quiz**	25%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	40 %	**Other**	-		
Textbook	S. Warren and P. Organic Synthesis: The Disconnection. Approach, Warren. 2nd edition, (2008).							
References	1. M. B. Smith. Organic Synthesis. Academic Press. 4th edition, (2016). 2. R. B. Grossman. The Art of Writing Reasonable Organic Reaction Mechanisms. Springer. (2010).							