توصيف مقررات برنامج البكالوريوس

Kingdom of Saudi Arabia
Ministry of Education
Umm Al Qura University
Al Jamoum University College
Chemistry department

SYLLABUS

A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23051101-4	General chemistry 1	4	3	1	1st	-

B. Course content

This course includes:

Units of measurements; SI- units, intensive and extensive properties, uncertainty in measurements (precision and accuracy) , Significant figures: Rounding significant figures, Using significant figures in addition, subtraction, multiplication and divisions, States of matter and measurement, molecules and molecular compounds, Gases , The mole, simple quantitative calculations with chemical reactions , Basics of chemical equilibrium , Acids and bases , Thermochemistry, Electrochemistry

C. Course reference

P. Atkins and J. de Paula, Physical Chemistry, 10th ed., 2006, New York

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
General Chemistry(2)	23052302-2	2	2	-	3rd level	General chemistry1

B. Course content

This course includes:

• Electronic structure – atomic shells and their shapes.
• Bohr theory of hydrogen atom.
• Principle quantum numbers.
• Properties of elements and the periodic table – classification of elements into periods and groups.
• Comparison between some properties of the elements inside the period such as; ionization energy, electron affinity, electronegativity and atomic size.
• Chemical bonds; their types and theories – Lewis symbols and structures.
• Valence shell electron pairs repulsion theory.
• Valence bond theory.
• Hybridization and its types
• Molecular orbital theory – octet rule.
• Properties of ionic and covalent compounds.

C. Course references

1. List Required Textbooks

- General Chemistry: The Essential Concepts 7th Edition by Raymond Chang Dr., Kenneth Goldsby Professor, 2013.

2. List Essential References Materials (Journals, Reports, etc.)

- D. A. McQuarrie, J. D. Simon. Physical Chemistry: A Molecular Approach. University Science Books, 1997.

- J. D. Lee, Concise Inorganic Chemistry, 5th ed., Wiley-Blackwell, 1998.

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Chemistry of Aliphatic Compounds	23052331-3	3	2	1	2nd level	General chemistry1

B. Course content

This course includes:

Nomenclature of Hydrocarbons
Alkanes (Preparation, physical properties, chemical reactions cycloalkanes, conformations in cycloalkanes)

Alkenes (Preparation, physical properties, chemical reactions conjugated dienes, free radical addition, Diels alder reaction, and 1,4 cycloadditions in dienes

Alkynes (Preparation, Acidity of terminal alkynes, chemical reactions, induserial uses of alkynes)

Alkyl halides and dihalides (nomenclature, preparations and reactions)

Alcohols anddihydric and trihydric alcohols (nomenclature, chemical properties) and thioalcohols

Ethers (nomenclature, preparations and chemical properties) and thioethers

Organometallic compounds and Grignard reagents

Carbonyl compounds (nomenclature, preparation and chemical properties

Carboxylic acids and their derivatives (nomenclature, preparation and chemical properties)

Amines(nomenclature, preparation and chemical properties)
Inductive effect, resonance effect and stereochemistry

C. Course references

1. List Required Textbooks

• T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "Organic Chemistry, 11th Edition, International Student Version" 2013, John Wiley & Sons.

• John McMurry's "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole

2. List Essential References Materials (Journals, Reports, etc.)

• Lecture Hand outs available on the coordinator website

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

• AmitArora "Introductory Organic Chemistry" 2006, Discovery Publishing House New Delhi

• M. Casey, J. Leonard, B. Lygo, G. Procter "Advanced Practical Organic Chemistry" 1990, Springer US

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23052333-3	Volumetric and Gravimetric Analytical Chemistry	3	2	1	3rd level	General chemistry

B. Course content

This course includes:

Classification and applications of quantitative analysis and solution concentration parameters.

The principles of volumetric analysis and statistical methods – neutralization titrations theory- pH measurements.

Buffer solutions, their working theory and their applications- Indicators in neutralization titrations and the applications of neutralization titrations in manufacture, pharmaceutical and biochemistry fields

Precipitation theory, adsorption indicators, applications of precipitation titrations and titrations which include complexes formation.

Complexiметry titrations and their applications in water analysis and manufacture and reduction – oxidation (Redox) titrations and their applications.

Principles and requirements of gravimetric analysis.

Theoretical principles of precipitation and stages of saturated, supersaturated and solubility product, precipitation formation (nucleation, precipitate growth

Factors affecting the solubility of precipitate, precipitation from homogeneous solution and contamination of precipitates, types of contaminates (co-precipitation post precipitation, surface adsorption)

The methods of contaminates removing or minimizing

Organic precipitants, requirements and its application, Inorganic precipitants, requirements and its application

Calculations of gravimetric analysis

C. Course references

Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014)

Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014)

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23052334-2	Qualitative Analytical Chemistry	2	1	1	3rd level	General chemistry

B. Course content

This course includes:

Inorganic qualitative analysis: its classifications and its applications

The solutions (Types of solutions – the solubility and factors effecting solubility – Solubility of aqueous ,ionic and non ionic compounds –methods for expression concentrations

The chemical equilibrium – The rate of chemical reactions.

Acid- Base equilibrium, Dissociation of water, pH and Neutralization Indicators

Hydrolysis of salts, acids and weak base

Buffer solution in qualitative analysis

Colloidal solutions (colloidal particles and electric charge – pepitization – colloidal particles precipitation – conditions of ideal precipitation)

The precipitates and law of solubility product

The factors effecting on the solubility of precipitates and separations of ionic groups.

equilibrium of complex formation (Coordination complexes, its structure and types of bonds in ionic complexes)

Types of ionic complexes –application of equilibrium law on complexes reactions - application of complex formationin qualitative analysis

Oxidation reduction equilibrium.

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C. Course reference

Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, Analytical Chemistry, 7th edition, Springer (2014)
Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Analytical Chemistry, 7th edition, WILEY (2014)

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23052335-3	Thermodynamics	3	2	1	3rd level	General chemistry

B. Course content

This course includes:

1-General introduction: objectives of the thermodynamics, some thermodynamics terms.

2-Heat, energy and work (the mechanical equivalent of heat). Different types of systems .

3-Thermodynamics variables and characteristics of intensive, extensive and thermodynamics processes.

4-Zero and first laws of thermodynamics and their applications.

5-The relationship between enthalpy change and internal energy change, heat capacity

6-The Jules-Thompson's effect, Adiabatic and isothermal expansions, Determination of Joule's coefficient from heat capacity measurements.

7-Thermochemistry. Exothermic and endothermic reactions. Kirchhoff's law, Hess's law and its applications.

8 -The second law of thermodynamics and its applications.

9- Spontaneous and non spontaneous processes. Heat machines and thermal efficiency

10- Heat transfer to work. Carnot cycle (efficiency and compression ratio) Otto cycle.
11- Entropy. Gibbs free energy, work function, Gibbs and Gibbs –Helmholtz Equations.
12- Van't Hoff Equations, Chemical Equilibrium and spontaneity.
13- Third law of thermodynamics and its applications.

C. Course references

- S. Bahl, Advanced Physical Chemistry, S. Chand & Co., 1993, New Delhi, India.
- R. A. Alberty and R. J. Silbey, Physical Chemistry, 1992, John Wiley & Sons.
- J. P. Bromberg, Physical Chemistry, 1980, Allyn and Bacon.
- P. Atkins and J. de Paula, Physical Chemistry, 7 th ed., Oxford University press, New York, 2014

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A. Course identification

Course name	Course number	Credit hours	lect	Lab	Course level	Pre-requisites
Chemistry of the Main Group Elements	23052437-2	2	2	-	4th level	General Chemistry 2

B. Course content

This course includes:

General and periodic properties of main group (non-transition) elements; electronic structure, size, electron affinity, ionization, electronegativity &electropositivity and oxidation states
Horizontal, perpendicular and diagonal relationships in periodic table
. Hydrogen and its position & properties, its isotopes and chemical properties
s-bolck elements; electronic configuration, size, hardness, melting points – chemical properties; chemical reactivity with metals, nitrogen, acids, complexes formation – solubility and hydration – solubility in ammonia
Halides – some chemical properties of lithium and magnesium – diagonal relationship between lithium .and magnesium elements

Chemical properties of beryllium and differences between it and second group elements –

diagonal relationship between beryllium and aluminum

C. Course references

- A. G. Massey, Main Group Chemistry, 2nd Edition, Wiley, 2000. - F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry , A comprehensive text, 1988, John Wiley & Sons.

Das, Kumar V.G, Main Group Elements and their Compounds, Springer, 1996

Das, Kumar V.G, Main Group Elements and their Compounds, Springer, 1996

- None.

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Chemistry of Aromatic Compounds	23052431-3	3	2	1	4th level	Chemistry of Aliphatic Compounds

B. Course content

This course includes:

Aromaticity: Huckelrule and annulenes

Benzene: molecular orbital theory point of view, stability and resonance

Chemical properties of benzene: friedel-crafts reactions and their applications in organic syntheses

Electrophilic substitution reactions

Reactivity and orientation in benzene ring – second electrophilic substitution

Reactivity and orientation in benzene alkyl derivatives

Aromatic amines and their derivatives

C. Course references

John McMurry's "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole

1. Amit Arora "Introductory Organic Chemistry" 2006, Discovery Publishing House New Delhi 2. John McMurry's "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole 3. T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "Organic Chemistry, 11th Edition, International Student Version" 2013, John Wiley & Sons

• Lecture Hand-out available as a PowerPoint presentation

•http://www.chemweb.com
•http://www.sciencedirect.com
• http://www.rsc.org

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Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Electrochemistry	23052435-3	3	2	1	4th level	Thermodynamics

B. Course content

This course includes:

Introduction to electrochemistry-Types of electrochemical series Standard redox potentials

Cell potential

Electrode potential and Nernst equation.

Electrochemical series

Mid-Term exam

Standard electrode potentials- Hydrogen and oxygen electrodes.

C. Course references

Electrochemistry Principles, Methods and Applications, Christopher M. A. Brett, Maria Oliveira Brett, Oxford University Press, 2005.

1- A.J. Bard ,L.R. Faulkner, Electrochemical Methods , Fundementaland Applications,2010 John Wiley & Sons
2- Handbook of Electrochemistry, Cynthia Zosk, Elsevier, 2011.

3- Handbook of Corrosion Engineering (Chinese), Pierre R. Roberge, McGraw-Hill, 2005.
4- Corrosion Basics: An Introduction, Pierre R. Roberge, NACE International, 2006.

Power point lectures, Videos .

Web sites..

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Kinetic Chemistry	23052436-3	3	2	1	4th level	Thermodynamics

B. Course content

This course includes:

General concepts in chemical kinetics.

Factors affecting the rate of reaction.

Conventional techniques of following a reaction

Integration of simple rate laws.

Types of reaction orders

Determining the rate law from experimental data

C. Course references

• An Introduction to Chemical Kinetics, Margaret Robson Wright, New York, John Wiley & Sons, 2004.
• Kinetics of Chemical Reactions, Guy Marin, Gregory S. Yablonsky,John Wiley, 2011.
• Chemical Kinetics, Luis Arnaut, SebastiaoFormosinho, Hugh Burrows, 1st ed., Elsevier Science, 2006.

• Physical Chemistry, Amazon logo Silbey, R. R. Alberty, M. Bawendi, 4th ed., John Wiley & Sons, 2004. • Physical Chemistry, Peter Atkins & Julio de Paula, 10th ed., W. H. Freeman and Company, 2014
'

• Principles of Chemical Kinetics, Second Edition, James E. House, 2nd ed., Academic Press, 2007.

• http://www.chemweb.com
• http://www.sciencedirect.com
• http://www.rsc.org
• Websites on the internet relevant to the topics of the course

Not required

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Organic analytical chemistry	23052433-3	3	2	1	4th level	Volumetric and Gravimetric Analytical Chemistry

B. Course content

This course includes:

Determination of elements in organic compounds

Determination of Carboxylic acids

Determination of esters

Determination of amino groups

Determination of hydroxylic groups

Determination of carbonyl groups and their derivatives

Determination of nitro and nitroso groups

Determination of the state of unsaturation in organic compounds

Determination of organic peroxide

Determination of isothiocyanate and isocyanates

Discussion the formation method of oxime (equilibrium and kinetic study) as a model in organic analytical chemistry

C. Course reference

Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, ***Analytical Chemistry***, 7th edition, Springer (2014)

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A. Course identification

Course name	Course number	Credit hours	lect	Lab	Course level	Pre-requisites
Colloid Chemistry and Phase Rule	23052439-1	1	1	-	4th level	General Chemistry(2)

B. Course content

This course includes:

Definition of colloids with examples

Classification of colloids

Theory of colloid stabilization

Methods of colloids preparations

Colloid technology, Colloid properties

Importance of colloids and its importance

C. Course reference

Handbook of Applied Surface and Colloid Chemistry, Vol. 1-2,Holmberg, Krister, John Wiley & Sons, New York, 2002. •

PHYSICAL CHEMISTRY IN BRIEF, Josef P. Novak, Stanislav Labık, IvonaMalijevska, Institute of Chemical Technology, Prague,2005.

Emulsions, Foams, and Suspensions: Fundamentals and Applications, Laurier L. Schramm, WILEY-VCH Verlag GmbH &Co, 2005. • Colloidal Chemistry, A. Goel, Discovery Publishing House, 1st ed., New Delhi, 2006.

Not required.

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Stero Physical Organic Chemistry	23053531-3	3	3	-	5th	Aromatic Chemistry

B. Course content

This course includes:

- Thermodynamic parameters affected the reactions.
- Reaction kinetic and determination of the reaction orders.
- Determination of reaction mechanism by physical and chemical properties.
- Factors affecting the distribution of electrons in molecules:
(Inductive effect- Mesomeric effect- Steric effect).
- Nucleophilic substitution reaction SN1 and SN2.
- Elimination reactions E1 and E2.

- Electrophilic addition to carbon-carbon double bond.
- Nucleophilic addition to carbonyl group.
- Free radicals reactions.

C. Course references

1- "Modern Physical Organic Chemistry" Eric V. Anslyn, Texas, Austin Dennis A. Dougherty, University Science Books Sausalito, California, 2005.

2-Howard Maskill "Structure and Reactivity in Organic Chemistry, Volume 81 of Oxford Chemistry Primers" 1999, OUP Oxford.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
23053537-2	Chemistry of Transition Elements	2	2	-	5rd level	Chemistry of the Main Group Elements

B. Course content

1- The site transition elements in the periodic table.
2- d-block elements, first transition series (3d), second transition series (4d) and third transition series (5d).
3- f-block elements: lanthanides series (4f) and actinides series (5f).
4- Differences between d-block and f-block elements.
5- Comparisons between 4d and s, p block elements.
6- Characteristic properties of first transition series.
7- Magnetic properties from crystal field theory.
8- Electronic distribution of electrons in d orbitals on octahedral complexes.
9- Comparison between the properties of first transition series (3d) with the second transition series (4d) and third transition series (5d).
10- Comparative studies of transition elements in their groups; scandium group, titanium group, vanadium group, chromium group, manganese group, iron, cobalt & nickel groups, copper group, and zinc group.
11- f-block elements: studies of lanthanides and actinides in comparison with scandium group in terms of abundance, electronic configuration, oxidation states and lanthanides contraction.
12- Spectroscopic and magnetic properties – difference between 4f and 5f and its effect on chemical behavior.

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C. Course references

J. D. Lee, Concise Inorganic Chemistry, Van Nostrand Reinhold Company, 1992, New York.
J.C. Bailar, H.J. Emelens, H.J. Emelens, R. Nyholm and A.F. Trotman, Comprehensive Inorganic Chemistry,
1994, Pergaman press, Oxford.
F.A. Cotton, G. Wilkinson, C.A. Murillo, M. Bochmann, Advanced Inorganic Chemistry: A comprehensive Inorganic Chemistry 1994, Pergaman press- Oxford.

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23053536-2	Quantum Chemistry	2	2	-	5rd level	General chemistry2+ calculus

B. Course content

1- Basics of Quantum Theory – Introduction to Quantum Mechanics And Its Origin – Properties of Wave Function.

2- Solution of Schrödinger Equation – Applications of Schrödinger Equation - A Particle Moving in A Box With Different, One – Two – Three, Dimensions - Predict the Wave Function Equation and the Energy in Each Case.

3- Operators and its Importance in Quantum Chemistry - Eigen Functions and Eigen Values

4- Schrödinger Equation Of Hydrogen Atom- Wave Function Equation and Energy

5- Different Quantum Numbers and their Uses in Describing the Orbitals and the Energy Levels.

6- Quantum Theory and Molecular Structure – Born-Oppenheimer Approximation.

7- Molecular Orbital Theory and Molecular Structure- Linear Combination of Atomic Orbitals (LCAO).

8- Application of Molecular Orbital Theory on Homonuclear Molecules.

9- Application of Molecular Orbital Theory on Heteronuclear Molecules.

10- Overlap Matrix- Correlation Diagrams.

C. Course references

- .N. Levine, Quantum chemistry, 6 rd edition, Allyn & Bacon, Inc. 1993.

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Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23053535-3	Surface chemistry	3	2	1	5th level	Colloids and phase rule

B. Course content

This curse includes:

1- Introduction in surface tension and its determination

2- kelvin and young Laplace equations

3- Effect of temperature on surface tension and Parachor

4- Single crystal surface, simple and complex surface structures and Millar indices

Relaxed, reconstructed, faceted surfaces

5- Bimetallic surfaces.

6- Adsorption of gas on solid surfaces, and method of determinatio

7- Frindlish, Langmuir and BET adsorption isotherms

8- Some microscopic and spectroscopic tools of surface characterization such as:

SEM, TEM, AFM, STM, XRD , XPS,…….

C. Course references

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Surface Analysis: The Principal Techniques, 2nd Edition, John C. Vickerman, Ian Gilmore, Wiley, 2009.

Introduction to Surface Chemistry and Catalysis, Gabor. A. Samorgi, 2nd ed., L. Yimin, Wiley, 2010.

Surface Chemistry, Elaine M. Mc Cash , 1st ed., Oxford University Press, 2001.

SYLLABUS

A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites

Spectrophotometric and Electrochemical techniques	23053533-3	3	2	1

B. Course content

This course includes:

Ultraviolet and visible molecular absorption spectroscopy, Beer's law, true and apparent deviations from Beer's law, application of Beer's law to mixtures, calibration curve and the standard addition method- Absorbing species, absorption by organic compounds, charge-transfer absorption and ligand-field absorption bands- Qualitative and quantitative analysis by UV-Vis. Applications of spectrophotometric methods in chemical equilibrium studies, spectrophotometric titrations- Turbidimetry and nephelometry- Molecular fluorescence spectroscopy, theory of molecular fluorescence, relaxation process, resonance lines and stokes shifts, relationship between excitation spectra and fluorescence spectra, effect of structure, temperature and solvents on fluorescence, effect of concentration on fluorescence intensity, instrumentation and applications in organic and inorganic analysis-Flame emission and atomic absorption spectroscopy, nebulisation, burners and nebulizers, flames and flame temperature, interferences, flame spectrometric techniques, flame emission spectrometry, flame photometer, flame atomic absorption spectrometry and applications-Introduction to electroanalytical methods, pH and ion selective potentiometry, glass-membrane electrodes, solid-state sensors, liquid-membrane electrodes, gas-sensing and enzyme electrodes, interferences, potentiometric titrations-Voltammetry, polarography and amperometric titrations, current-voltage relationships, characteristics of dropping mercury electrode, half-wave potential, modern voltammetric techniques (ASV and CSV), instrumentation, applications, two indicator electrodes amperometric titrations- Electrogravimetry and calorimetry, basic principles, equipment for electrolytic separation, electrogravimetry, coulometry and coulometric titrations,

conductance methods, electrolytic conductivity, measurement of electrolytic conductance, direct concentration determination, conductometric titrations

C. Course references

Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, ***Analytical Chemistry***, 7th edition, WILEY (2014)
Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, ***Analytical Chemistry***, 7th edition, Springer (2014).

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Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Heterocyclic Chemistry	23053532-3	3	2	1	5th level	Chemistry of aromatic compounds

B. Course content

This course includes:

Classification of heterocyclic compounds
Nomenclature of monocyclic heterocyclic compounds as well as fused systems
Bonding, Structure and geometry in heterocyclic compounds: three, four, five and six membered heterocycles- Aromaticity – Basicity
Structure and reactivity of different heterocycles five and six-membered rings with one or more different heteroatoms (same or different heteroatoms).
Chemical reactions of different heterocyclic compounds five and six-membered rings with one or more different heteroatoms (same or different heteroatoms).
Cycloaddition reactions (Diels-Alder [2+4]) of different heterocyclic compounds five and six-membered rings with one or more different heteroatoms (same or different heteroatoms).
Synthetic Routes to five membered rings with one or more different heteroatoms (same or different heteroatoms).
Synthetic Routes to six membered rings and fused

heterocyles with one heteroatom.

Synthetic Routes to six membered rings with two

heteroatoms (Diazines) (pyrimidine and pyrazine)

C. Course references

• Eric Scriven, Christopher A. Ramsden "Advances in heterocyclic chemistry" 1st Ed., published: 1st June, Vol. 126, 2018. Hardcover ISBN: 9780128152096, Imprint:

Academic Press. Elsevier

• Eric Scriven, Christopher A. Ramsden "Advances in heterocyclic chemistry" 1st Ed., published: 3rd February, Vol. 125, 2018. ardcover ISBN: 9780128152102, Imprint: Academic Press. Elsevier.

• Eric Scriven, Christopher A. Ramsden "Advances in heterocyclic chemistry" 1st Ed., published: 4th January, Vol. 124, 2018. E-Book ISBN: 9780128137611, Hardcover ISBN: 9780128137604, Imprint: Academic Press, Elsevier

• Gordon Gribble, John Joule "Progress in heterocyclic Chemistry" 1st Ed., Published: 5th September, Vol. 29, 2017. E-Book ISBN: 9780081023112, Hardcover ISBN: 9780081023105, Imprint: Elsevier

• Alan R. Katritzky, Christopher A. Ramsden, John A. Joule " Advances in heterocyclic Chemistry" 1st Ed., Published 7 Novmber, Vol. 113, 2014. ISBN 10 0080958435, ISBN

13 9780080958439, Imprint: Elsevier / The Lancet

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Spectroscopic organic chemistry	23053631-3	3	2	1	6th level	Stero Physical Organic Chemistry

B. Course content

This course includes:

Principals of spectroscopy and index of hydrogen deficiency.
UV Spectroscopy: ground and excited states, molar absorptivity, an calculation of A max to the possible structure.
Applications and solving problems.
Factors affecting absorption frequency, experimental aspects of IR spectroscopy.
Interpretation of IR charts.
The nature of NMR absorption instrumentation; chemical shifts in 1H NMRspectroscopy.
Shielding and de shielding effect magnetic anisotropy, spin-spin coupling in

1H NMR spectroscopy.

13C NMR spectroscopy (chemical shift);more complex spin-spin splitting

patterns.

Mass Spectrometry (MS): ionization process and instrumentation.
Examples of common types of fragmentation processes.
Applications and solving problems.
Apply all Spectra.

C. Course references

• Pavia, D.; Lampman, G.M.; Kriz, G.S.; Vyvyan, J.R. Introduction to Spectroscopy, 4 th edition, 2009, Belmont : Brooks/Cole, Cengage Learning.

• Silverstein, R.M.; Webster, F.X.; Kiemle, D.J. Spectrometric Identification of Organic Compounds. 7th edition, 2005, N.Y. : John Wiley & Sons, Inc.

• Prof.Dr.AbdullahM.Asiri,MahaM.Al-Otaibi"Spectroscopic Methods in Organic Chemistry, 1st Edition, 2012.

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23053633-3	Separation Methods and Thermal Analysis	3	2	1	6th level	Spectrophotometric and Electrochemical techniques

B. Course content

This course includes:

Separation methods in analytical chemistry, classifications , and solvent extraction technique- Principles of chromatographic methods and its classification- Column chromatography- Liquid-liquid chromatography and Solid-liquid chromatography- Ion exchanger chromatography, ionic chromatography and HPLC- Plane chromatography- Thin layer chromatography (TLC), paper chromatography (PC) and electrophoresis method- Gas chromatography- Gas chromatography in qualitative, quantitative, medical and petroleum analysis- Principles and devices of previous analysis methods- Thermal analysis methods: thermo gravimetric analysis (TGA), (DTG), (DSC) and (DTA)- Calometric analysis and thermal titrations.

C. Course references

Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, ***Analytical Chemistry***, 7th edition, WILEY (2014)
Douglas A. Skoog, Donald M. West, James F. Holler and Stanley R. Crouch, ***Analytical Chemistry***, 7th edition, Springer (2014)

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Chemistry department

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Catalysts Chemistry	23053635-3	3	2	1	6rd level	Surface chemistry

B. Course content

This course includes:

Introduction (The phenomenon catalysis, mode of action of catalysts, activity, turnover Frequency TOF, turnover number TON [T 46], selectivity, stability, classification of catalysts and comparison of homogeneous and heterogeneous catalysis).
Economic importance of catalysts.
Methods of catalyst preparation
Some spectroscopic and microscopic tools of catalyst characterization.
Examples include catalysts for oxidation, including pollution clean-up; hydrogenation including hydrogenation and refining processes
Pollution control with particular reference to car exhausts

C. Course references

1- Catalysis Concepts and Green Applications, Gadi Rothenberg , **John Wiley & Sons, 2008.**
2- Catalysis for Renewables From Feedstock to Energy Production, Gabriele Centi and Rutger A. van Santen, WILEY-VCH Verlag GmbH &Co.KGaA, Weinheim, 2007.
3- Synthesis of Solid Catalysts, Krijn P. de Jong, WILEY-VCH Verlag GmbH &Co.KGaA, Weinheim, 2007.
4- Industrial Catalysis: A Practical Approach, Second Edition. Jens Hagen WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006, ISBN: 3-527-31144-0.
5- B. Cornils, W. A. Herrmann, R. Schlögl, C.-H. Wong Catalysis from A to Z A Concise Encyclopedia 2nded 2003, ISBN 3-527-30373-1

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Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
23053637-3	Coordination Chemistry	3	2	1	6rd level	Chemistry of Transition Elements

B. Course content

This course includes:

1- Introduction to the chemistry of coordination compounds - Werner theory of coordination compounds - Effective atomic number.

2- Ligands – nomenclature of metal complexes – symmetry in metal complexes.

3- Valence bond theory – coordination numbers and geometrical structures – inner and outer complexes.

4- Stability of metal complexes; factors affecting the stability of metal complexes – ionic and ionization potential – geometrical arrangement of ligands around the central metal ion - metal chelates.

5- Crystal field theory; ligand field in octahedral complexes – ligand field in tetrahedral complexes – ligand field in square planer complexes – Jahn-Teller effect (distortion from symmetrical arrangement) – crystal field stabilization energies.

6- Preparation of coordination compounds (complexes); direct reactions – oxidation and reduction reactions – thermal decomposition reactions.

7- Electronic spectrum of complexes - infrared spectra of the metal complexes.

8- Metal complexes of significant biological activities.

C. Course references

James E. Huheey , Inorganic chemistry , Prentic Hall ; (4th edition) , 1997

William L. Jolly, Modern Inorganic Chemistry; (2nd edition) McGraw-Hill, New York, 1991.

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Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Chemistry of Organic Reactions and Preparations	23053632-3	3	2	1	6th level	Heterocyclic Chemistry

B. Course content

This course includes:

Introduction to organic synthesis
Chemistry of functional groups: carbonyl compounds,carboxylic acids/their derivatives, amines, nitriles, and sulfides/sulfoxides.

Named reactions: Aldol condensation - Claisen condensation– Claisen rearrangement - Friedel–Crafts acylation – Grignard reaction –Michael reaction – Wittig reaction – Suzuki coupling – Diels-Alder reaction.

Protection and deprotection of function groups: Hydroxylgroup, carbonyl group, carboxylic group, and amino group
Redox reactions and selectivity

C-C bond formation: free radicals, enolates, couplingreaction
Pericyclic reactions
Retrosynthetic approach

Chemoselectivity

C. Course references

• T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "Organic Chemistry, 11th Edition, International Student Version" 2013, John Wiley & Sons.

• J. McMurry "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole

• Stuart Warren, Paul Wyatt "Organic Synthesis: The Disconnection Approach, 2nd Edition" 2008, Wiley-Blackwell.

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Chemistry of Natural Products	23054731-2	2	2	-	7th level	Chemistry of organic reactions and preparations

B. Course content

This course includes:

Definition, classification, nomenclature and Identification of natural

products: Terpenoids – Steroids – Alkaloids

Terpenoids : Introduction and isolation from plants – general structure and nomenclature – classification – general methods of determination of the molecular structures and their preparations, for examples: (Acyclic monoterpenoids (myrcene)- Monocyclicmonoterpenoids (limonene)- Bicyclicmonoterpenoids (camphor)-Sesquiterpenoids (farnesol)- Triterpenoids (squalene)- Tetraterpenoids (β-carotene).

Steroids : Introduction and their natural abundance – the difference between steroid compounds – nomenclature – structure elucidation of steroids – methods of preparation of steroids, for examples: Sterols (cholesterol) – Sex hormones (Estrogens (estraiol), Androgenes (testesterone) and Gestogenes

(progesterone)- Bile acids (cholanic acid).

• Alkaloids : Introduction and methods of extractions – general properties – classification of alkaloids, structure elucidation of alkaloids and methods of their preparation, for examples: Phenyl methyl group (adrenaline)-Pyrrolidine group (hygrine)-Pyridine group (trigonelline)- Pyrrolidine and Pyridine group (nicotine)- Indole group (heptaphylline).

C. Course references

• Raymond Cooper, George Nicola" Natural Products Chemistry : Sources, Separations and Structures, 1stEdition" 2014, CRC Press.

• RenshengXu, Yang Ye, Weimin Zhao" Introduction to Natural Products Chemistry, 1stEdition" 2011, CRC Press

• Sujata V. Bhat, B.A. Nagasampagi, MeenakshiSivakumar "Chemistry of natural products , 1stEdition" 2005, Springer.

• P.M. Dewick "Medicinal Natural Products: A Biosynthetic Approach", 2nd Edition, Wiley & Sons, 2002 and 3rd Edition, Wiley & Sons, 2009.

• J. R. Hans Editor E. W. Abel "Natural Products : The Secondary Metabolites" Copyright: 2003.Print ISBN: 978-0-85404-490-0

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Chemistry of Petroleum and Petrochemicals	23054732-3	3	2	1	7thlevel	Chemistry of Organic Reactions and Preparations

B. Course content

This course includes:

Definition of Petroleum and it origin formation and traps
Methods of exploration and Petroleum Classification
Chemical Composition of Petroleum
Field separation of crude oil (Desalting, water treatment, gas treatment)
Refining operations and Fractional Distillation of crude oil
Crude oil Distillation products: light distillates (natural Gas, gasoline and naphtha) - Mild distillates (kerosene, heating oil and jet fuel and diesel fuel) - heavy distillates (lubricates oil and waxes, asphalt and coke oil).
Chemical conversion processes of crude oil: Cracker processes (thermal cracking and catalytic cracking and hydrocracking) - Combining processes (polymerization and alkylation) - Rearrangement processes (catalytic reforming and isomerization and improving the octane and cetane number) - Purification by hydrogen treatment (removing hydrogen sulfide compounds mercaptans and compounds of nitrogen. Etc.).
Petrochemicals definition – History of Petrochemicals industry
Production of petrochemicals and industrial uses

C. Course references

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Petroleum and petrochemical course presented by the lecturer.

J. G. Speight, The Chemistry and Technology of Petroleum, 5th ed. CRC Press, 2014, P. 953, ISBN: 9781439873892. • R. Curley, Fossil Fuels. Britannica, 2012, P. 160, ISBN 9781615305407. • M. A. Fahim, T. A. Alsahhaf, A. Elkilani, Fundamentals of Petroleum Refining, Elsevier, 2010, P. 496, ISBN 9780444527851. • D. S. J. Jones, Peter R. Pujadó, Handbook of petroleum processing, Springer Dordrecht Netherlans, 2006.
• S. Matar, L. F. Hatch, Chemistry of Petrochemical Processes, 2nd ed. 2001, P. 392, ISBN 9780884153153.
• Uttam Ray Chaudhuri. Fundamentals of Petroleum and Petrochemical Engineering. December 13, 2010 by CRC Press.

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A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Reactions mechanism and spectroscopy	23054737-2	2	2	-	7 th level	Coordination Chemistry

B. Course content

This course includes:

ntroduction on the basic concepts of inorganic reaction mechanism.
The rate Laws for several inorganic chemistry reactions.
Labile and inert complexes
Reaction mechanisms of ligand substitution.
Substitution reactions in square planar complexes, trans effect and the theories for it's explanation.
Reactions include the substitution of coordinating water.
Methods studying complexes reactions-octahedral & square- planar
Substitution reactions in octahedral complexes - dissociation and association mechanisms - equation reactions.
Aqueous ionic complexes, step wise complex formation, factors affecting the stability of complexes, acids and bases.
Mechanism for oxidation-reduction reaction, inner sphere and outer sphere reactions. Introduction on the electronic spectra of transition metal complexes and Russell Saunders coupling effects.
Energy level diagrams for different selective complexes.

C. Course references

• Robert B. Jordan, Reaction mechanisms of inorganic and organometallic systems, 3rd , Oxford University press, 2007.
• Smiljko Asperger, Chemical kinetics and inorganic reaction mechanisms, 2ed, Kluwer Academic / Plenum Publisher 2003.
• Kazuo Nakamoto, Infrared and Raman Spectra Of Inorganic And Coordination Compounds, John Wiley & Sons , 2009.
"Kinetics and Mechanisms of Reaction of Transition Metal Complexes," Ralph G. Wilkins, 2nd Thoroughly Revised

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23054733-2	Environmental chemistry	2	2	-	**7th level**	Separation Methods and Thermal Analysis

B. Course content

Principles of environmental chemistry and chemical analysis

Energy and energy cycles and gases cycles

Role of human in environmental pollution

Atmosphere chemistry

Air pollution (classification-sources –problems-global warming phenomenon)

Water treatment chemistry

Water pollution (water quality- types of contaminants- water pollution control)

Soil chemical analysis.

C. Course references

Donald L. Sparks, *Environmental Soil Chemistry*, 2nd Edition, Academic Press (2003)
Stanley E. Manahan, *ENVIRONMENTAL SCIENCE, TECHNOLOGY, AND CHEMISTRY,* 2000, CRC Press LLC

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23054738-2	Organometallic Chemistry	2	2	-	7rd level	Coordination Chemistry

B. Course content

1-History and nomenclature of σ-bonded and π-bonded complexes.
2-Eighteen electron rule – oxidation number.
3-Preparation organometallic compounds: direct reactions between metals and alkyl halides.
4-Preparations involve organometallic compounds: reaction with organic halides, reaction with free metals and their compounds.
5- Substitution reactions: substitution of hydrogen with meta.
6-Addition reactions: addition of metallic compounds to multiple bonds and electrochemical methods.
7-Structure and bonding in organometallic compounds: σ -bonded organometallic compounds – complexes of alkynes and alkenes- π-bonded organometallic compounds.
8-Application of organometallic compounds in organic preparations: organolithium compounds, organomagnesium compounds, organocopper compounds, organoaluminium compounds, organosilicon compounds, organoiron compounds.
9-Organometallic complexes of transition metals – unsaturated hydrocarbons.
10-Catalytic applications of organometallic compounds.

C. Course references

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SYLLABUS

A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Solution Chemistry and Kinetic Theory of Gases	23054736-2	2	2	-	7th level	Kinetic chemistry

B. Course content

This course includes:

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Basic concepts of solutions. Colligative properties of solutions. Electrolytic solutions, Faradays law, electrochemical equivalent. Electrical conductance applications and Kolwrawsh Law. Conductometirc titrations. Transport numbers, ionic migration and Oswald Law. First periodic exam Activity, activity coefficient and ionic strength Strong electrolytes theories. Kinetic theory of gases and its applications Collisions between gas molecules. Molecular velocities, viscosity of gases, Van der Walls Equation Second periodic exam.

C. Course references

1-Physical Chemistry, Amazon logo Silbey, R. R. Alberty, M. Bawendi, 4th ed., John Wiley & Sons, 2004.

2- Physical Chemistry, Peter Atkins & Julio de Paula, 10th ed., W. H. Freeman and Company, 2014.

3-Chemistry, Raymond Chang, 10th Edition, Publisher: Thoma D. Timp, 2014.

4-Solution Chemistry, P. Somasundaran and Dianzuo Wang, Mineral and Reagents, Elseiver, 2006.

5-Kinetic Theory of Gases, Walter Kauzmann, Dover Publications, 2014.

SYLLABUS

A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Molecular Spectroscopy	23054735-2	2	2	-	7th level	Quantum Chemistry

B. Course content

This course includes:

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Introduction to molecular structure and electromagnetic radiation

Rotational spectra- Rigid rotor

Vibrational spectra – harmonic oscillator

Electronic spectra

NMR

Molecular symmetry and spectroscopy

C. Course references

- I.N. Levine, Molecular Spectroscopy, Wiley Interscience, New York, 1975.

- W. J. Moore, Physical Chemistry, 5th edition, Longman, 1972.

- K. Anderson, Fundamental of Molecular Spectroscopy, John Wiley& Sons, 3rd Edition, 1992.

- J. Michael Hollas, Modern Spectroscopy, 4th ed. John, Wiley & Sons New York, 2004.

SYLLABUS

A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Polymer Chemistry	23054831-3	3	2	1	8th level	Chemistry of Petroleum and Petrochemicals

B. Course content

This course includes:

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Introduction and definitions

Basic principles of polymer classification – Polymer

architecture – Types of polymers

Molecular weight of polymers
Condensation polymers - addition polymer
Mechanisms of polymerization reactions - copolymerization

Physical properties of polymers
Thermal transitions of polymers: glass transition state Tg – factors affecting on Tg

Polymer uses and future applications

Mechanical properties of polymers
Industrial synthesis of polymers and technology

C. Course references

• L. H. Sperling, Introduction to Physical Polymer Science, 4th Edition, Wiley, 2006.

• I. M. Ward and J. Sweeney, An Introduction to The Mechanical Properties of Solid Polymers, 2nd Edition, Wiley, 2004. (TA455.P58 W36 2004).

• Stanley R. Sandler, Polymer Synthesis, Vol. III, Academic Press, 1980.

• Stanley R. Sandler, Polymer Synthesis, Vol. I, Academic Press, 1974.

2. List Essential References Materials (Journals, Reports, etc.) • Lecture Hand outs available on the coordinator website

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

1. John McMurry's "Organic Chemistry, 8th edition, International Edition" 2011, Brooks/Cole.

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23054837-2	Solid State Chemistry	2	2	-	8th level	Coordination Chemistry

B.Course content

1- Introduction to solid state chemistry.
2- Study the crystal structures properties, crystal lattice, type of crystals (covalent - ionic)- cubic centered face- cubic centered body.
3- Learn Bravais lattices.

4- Study the symmetry operators , elements and axis of rotation, symmetry and point group of molecules and point group of unit cells-point groups and space groups.
5- Calculate the volume of the unit cell , atomic radius , number of molecules , close and square packing and the density.
6- X- ray diffractions and Bragg's law.
7- Crystal structure of solids: Solid crystallography- X-Ray crystallography (interference phenomenon and diffraction method).
8- X-ray diffraction in the crystal structure - X-ray absorption- X-Ray spectrum - experimental crystal study (Lewis method - Rotatable crystal- powder diffraction).
9- How to calculate Miller indices of directions and planes-calculate inter-planar d - spacing (dhkl).
10- The crystal binding in solid Material, lattice energy and ionic charge.
11- How to detect the crystal defects and types of defects.
12- Effect of impurities on the properties of semiconductors (n-type and p-type semiconductor).

C. Course references

- R. S. Murray& P. R. Dawson, Structural and Comparative Inorganic Chemistry, London 1976

A. R. West, Solid State Chemistry and applications, John Wiley &Sons 1985.

- A. R. West, Basic Solid State chemistry, John Wiley &Sons 1988

W. Dietze, Crystals, Growth, Properties and applications, 1981

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SYLLABUS

A. Course identification

Course name	Course number	Credit hours	Lect	lab	Course level	Pre-requisites
Special Topics in Organic Chemistry	23054832-2	2	2	-	8th level	Chemistry of Natural Products

B. Course content

This course includes:

a. Introduction to carbohydrate chemistry (classifications, different chemical structures of mono and disaccharides)

b. Reactions of carbohydrates, synthesis of Ascorbic acid, ascending and descending in sugar chain.

c. Nucleosides – Nucleotides –Nucleic Acids
d. Amino acid (protection of amino and carboxylic groups, Synthesis and reactions of amino acids

e. Proteins and peptides (chemical reactions, physical and chemical properties and different methods for their chemical configurations)

f. Fats and oils (chemical reactions, physical and chemical properties, saponification)

g. Chemistry and reaction of Carbenes and nitirene
h. Introduction to the basic principle photochemistry-Introductory concepts, The quantization of light and matter and the three principles of light matter interaction

i. Light nature and light sources
j. Light absorption and electronically excited states: Ground state

(S0), Excited states (S1, T1, T2), and energy transfer- fluorescence - phosphorescence

k. The fate of excited state:

a) Physical radiative and non-radiative deactivations processes of the excited state (Jablonski diagram);

b) Aspects of the chemical processes of excited states;

c) Intermolecular radiationless transitions of excited states;

d) Intermolecular physical processes of excited states

l. General types of photochemical reactions: The photochemistry of alkenes and carbonyl compounds. Photochemical cross-linking and degradation of polymers.

m. Applications of photochemistry in semiconductors (solar cells, storage of solar energy and its conversions)

n. Selected photochemical reactions

C. Course references

• T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder "Organic Chemistry, 11th Edition, International Student Version" 2013, John Wiley & Sons.

• P. Finch, Carbohydrates: Structures, Syntheses and Dynamics, Springer Science & Business Media, 2013.

• Ian Fleming, Pericyclic Reactions (Oxford Chemistry Primers) 1st Edition, 1999.

• Axel Griesbeck, Michael Oelgemöller, Francesco Ghetti, CRC Handbook of Organic Photochemistry and Photobiology, Third Edition, 2012.

• P. M. Collins, P. J. Ferrier, Monosacharides: Their Chemistry and Their Role in Natural

Products, 1995, John Wiley & Sons

• Nicholas J. Turro, Modern Molecular Photochemistry, University Science Books, 1991.

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23054835-2	Nanochemistry	2	2	-	8rd level	Surface chemistry

B. Course content

This course includes:

General introduction and history of nanotechnology.
Importance of the nanoparticles in industries and in our lives.

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Approaches in nanotechnology and typical syntheses of nanoparticles.
Properties of nanomaterials, chemical and physical property.
Reasons for changing the properties.
Classification of nanostructured and the chemical and physical properties of different nanostructured.
Carbon Based Nanomaterials (Fullerenes, carbon-nanotubes and graphene)
Nanomaterial based catalysts (inorganic nano materials, metal oxide supports, supported nano metal catalysts).
Methods of preparation of nano-formulations and mesoporous materials
Nanoparticle synthesis and fixtures nanoparticles and **nanocolloids**: Basic synthesis and fabrication methods for nanomaterials (CVD, impregnation, sol-gel, microemulsion, template, hydrothermal) titanium nanotubes with and without palladium, silver and gold nanoparticles and some other fixtures
Spectroscopic and microscopic tools used in nanomaterials characterizations
General industrial applications for nanoscale systems and fixtures, nano-optic applications, bio-nanotechnology applications and medical nanotechnology applications
Nanotechnology and clean technologies: What is a clean technology challenges facing us in the areas of energy, water and environment, exploring the contribution of nanotechnology to solve these problems, the current obstacles faced by nanotechnology.

C. Course references

1. Nanochemistry. G.B. Sergeev, K.J. Klabunde, Elsevier, 2013, ISBN: 978-0-444-59397-9
2. Introduction to Nanoscience and Nanotechnology, Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, John J. Moore, CRC Press. Copyright, 2009.
3. Nanomaterials and Nanochemistry, C. Bréchignac, P. Houdy, M. Lahmani, Springer Science & Business Media. Copyright, 2006.
4. "Nanochemistry, A Chemical Approach to Nanomaterials", G. Ozin and A. Arsenault, RSC (Royal Society of Chemistry), 2005.
   "Nanostructures and Nanomaterials", G. Cao, Imperial College Press, 2004

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SYLLABUS

A. Course identification

Course name	Course number	Credit hours	lect	lab	Course level	Pre-requisites
Chemistry of Energy Resources	23054836-2	2	2	-	8th	Electrochemistry

B. Course content

-The main sources of energy

- Problems associated with the use of conventional energy sources, including fossil fuels, chemistry of fossil foils, with regard to future supply and the environment.

- Nuclear energy:

-The atomic nuclei, atomic structure and composition of nuclei.

- Nuclear masses and stability of nucleus.

- Radioactive decay processes, alpha, beta and gamma decays.
- Radioactive decay and growth.

- Equations of transformation during nuclear reactions

- Fission, charge and mass distribution.

- Radioactive decay, Half-life, First order reaction, Source strength – Alpha, beta, gamma-radiation, x-rays, high-energy particles – Accelerators, Synchrotron -Solar energy

- An overview including principles of photovoltaics, dye sensitized solar cells and photoelectrochemical cells.

- Solar cells as cost effective alternative

- Impact on environment
- The working principles of a Fuel Cell.

- Fuel cells types
- Polymer Electrolyte Fuel Cell and Direct Methanol Fuel Cells as examples

C. Course references

• Textbook of Nuclear Chemistry, A. Singh, R. Singh, Campus Publishers, 2006

• Applied Photovoltaics, Stuart Wenham, Martin Green, and Muriel Watt, Earthscan, 2007, ISBN 1- 84407-407-3

• Fuel cells: problems and solutions, Vladimir S. Bagotsky, Second Edition, John Wiley & Sons, 2012.

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A. Course identification

Course number	Course name	Credit hours	lect	lab	Course level	Pre-requisites
23054833-2	Forensic Chemistry	2	2	-	8th level	Separation Methods and Thermal Analysis

B. Course content

Introduction to forensic chemistry

The quality in chemical analysis - quality assurance - quality control - quality management - Internal quality control - External quality control

Statistics used in analysing the results

Sample preparation, representative sampling techniques, reproducibility, replicates, duplicates, external standard, internal standard and matrix effect.

The most important analytical devices used in the chemical analysis process to analyse the ambiguity of the crime scene in forensic Chemistry

Video Comparative spectrum device, A highly efficient liquid chromatography, atomic absorption spectrometry, Ultraviolet and visible spectrometer ,)

Infrared device, Automated fingerprint system - Genetic Analysis System- Light microscopes

Analysis of Forensic Samples - Drug Analysis - Inks, Paints, Pigments, Blood Alcohol Analysis

Applications of analytical chemistry in the hair analysis - fingerprinting - forgery of banknotes and documents

The use of analytical chemistry in the analysis of toxins (drug analysis) - Chemical - abusive drugs

C. Course references

Ho, M. H. Analytical Methods in Forensic Chemistry, Ellis Horwood, Ltd., London, 1990.
Saferstein, R. Criminalistics; An Introduction to Forensic Science, 5th Ed., Prentice-Hall, Inc., NY, 1994.
Tebbett, I., Ed., Gas Chromatography in Forensic Science, Ellis Horwood, Ltd., London, 1993.
Lowry, W. T. Forensic Toxicology: Controlled Substances and Dangerous Drugs, Plenum Publ. Co., NY, 1979.
Yinon, J., Ed., Forensic Applications of Mass Spectrometry (Modern Mass Spectrometry), CRC Press, Boca Raton, FL, 1995.
Jay A. Siegel, Forensic Chemistry: Fundamentals and Applications, Wiley & Sons, 2015.
Lawrence Kobilinsky, Forensic Chemistry Handbook, Wiley & Sons, 2012.