Course Specifications

Course Title:	**Chemical Kinetics**
Course Code:	**31021444**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours:	**2 credit hours**
2. Course type	
a. University ☐ College ☑ Department ☐ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**8th level / 4th year**
4. Pre-requisites for this course (if any)**: Physical Chemistry I (31021331)**	
5. Co-requisites for this course (if any)**: None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	30	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	30
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	60

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces fundamental principles of chemical kinetics and different ways to determine rate law of reaction and Arrhenius parameters and present briefly collision and transition state theories.

2. Course Main Objective

- Provide the students with fundamental understanding of chemical kinetics and the calculations related to it.
- Introduce the students to the laws of reactions and expressions of rate of reactions.
- Introduce the students to the Arrhenieus equation, collision and transition state theory.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the basic concept in chemical kinetics including chemical rate, Reaction order, reaction types and factors affecting chemical rate.	1.1
1.2	Explain the Relation between the stoichiometric coefficients of reactants and the partial orders of the simple reaction.	1.2
1.3	Determine reaction order by looking to the rate law equation.	1.3
1...		
2	**Skills :**	
2.1	Solve problems using Arrhenius equation and rate laws.	2.1
2.2	Identify the order of reaction and differentiate between simple and complex reactions using mathematical relations and plots.	2.2
2.3	Use different experimental methods of determination of the rate of reactions, activation energy and reaction order.	2.3
2...		
3	**Competence:**	
3.1	Work effectively in groups and exercise leadership when appropriate.	3.1
3.2	Show responsibility toward self-learning and group participation.	3.2
3.3		
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Reaction rate and factors affecting the chemical rate.	6
2	Simple reactions	4
3	Experimental methods of measuring reaction rate.	4
4	Kinetics of complex reactions	4
5	Arrhenius equation.	4
6	Collisions theory	4
7	Transition state theory	4
8	***Final Exam**	
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the basic concept in chemical kinetics including chemical rate, Reaction order, reaction types and factors affecting chemical rate.	• Lectures • Debate and discussion • Assignments (Cooperative & Individual assignments).	• Evaluation of assignments. • Quizzes • Midterm exam. Final written exams.
1.2	Explain the Relation between the stoichiometric coefficients of reactants and the partial orders of the simple reaction.		
1.3	Determine reaction order by looking to the rate law equation.		
1.4			
2.0	**Skills**		
2.1	Solve problems using Arrhenius equation and rate laws.	*Lectures *Class discussions *Problem based learning. *assignments	1- Quizzes 2- Activity and interaction in class discussion. 3- Homework evaluation. 4- Mid-term exam 5- Final exam.
2.2	Identify the order of reaction and differentiate between simple and complex reactions using mathematical relations and plots.		
2.3	Use different experimental methods of determination of the rate of reactions, activation energy and reaction order.		
2…			
3.0	**Competence**		
3.1	Work effectively in groups and exercise leadership when appropriate.	• Working in small groups. *Individual & group assignments. * Problem based homework. * Class discussions. *Exercises.	• Evaluation of individual & group works. • Periodical exams • Final exam
3.2	Show responsibility toward self-learning and group participation.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments, Activities & Attendance	During Semester	10
5	Final Written Theoretical Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: (include amount of time teaching staff are expected to be available each week)

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**- Chemical Kinetics, by: K.J. Laidler, Prentice Hall (1987). -Principles of Chemical Kinetics, by: James E. House. Academic Press 2007.**
Essential References Materials	
Electronic Materials	**None**
Other Learning Materials	**None**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	* Lecture room with tables and/or movable chairs for student group work.
Technology Resources (AV, data show, Smart Board, software, etc.)	* Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Student professor	Questionnaires, Discussions
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Chemistry of Natural Products**
Course Code:	**31021440**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours: 3 credit hrs. (3T)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level 8, fourth year
4. Pre-requisites for this course (if any)**:** Organic Chemistry 2 (31021222)
5. Co-requisites for this course (if any)**:** none

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	60

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Natural products chemistry deals with the identification, extraction and eventual modification of compounds that are of natural origin - plants, animals, and bacteria - for pharmaceutical use and for other purposes.

- Students will be introduced to techniques and methodologies for the isolation and purification methods of organic compounds from natural origins. These and the instrumental characterization techniques of IR, NMR, Mass Spectroscopy, Liquid and Gas Chromatography are applied in studying compounds of interest. Topics that are covered include general methods of isolation, separation, purification, and structure determination of the natural products.
- Students are also guided through the basic secondary metabolic pathways that yield the terpenoids, alkaloids, prostaglandins and chlorophyll. The synthesis and biogenesis of these natural products are also discussed.

2. Course Main Objective

The objectives of this course are to:

1- Introduce students to the basic concepts of natural products chemistry.
2- Expose students to the knowledge of Classifications and Isolation techniques of natural products.
3- Give students an idea about the medical and pharmacological uses of different classes and subclass of natural products.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Define the concepts, terms, classification and basic principles in natural product chemistry	1.1
1.2	Recall the molecular structure, methods of preparations, chemical and biological properties.	1.2
1.3	Describe the main isolation and characterization techniques.	1.3
1…		
2	**Skills :**	
2.1	Write the methods of preparing the natural molecules.	2.1
2.2	Use knowledge to solve chemical problem related to the concepts.	2.2
2…		
3	**Competence:**	
3.1	Cooperate with his colleagues in teamwork searching of recent papers in the field of plant drug discovery to get insight into the application of natural products	3.1

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to the course	3
2	Classifications	3
3	Isolation techniques	3
4	Terpenes	4.5

5	Steroids	3
	Exam 1	1
6	Plant pigments: Porphin and porphyrins, chemistry of Haemin, chemical relationship with chlorophyll	3
7	Flavonoids and Coumarins	3
8	Alkaloids	4.5
9	Antibiotics	3
10	Non-ribosomal peptides	3
	Mid Term Exam	**1**
11	Arachidonic acid derivatives	3
12	Polyketides	3
	Exam 2	1
13	Shikimic acid pathway	3
	Final Exam	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the concepts, terms, classification and basic principles in natural product chemistry	• Lectures • Debate and discussion Working in small groups • Individual & group assignments	• Quizzes • Midterm exam. • Assignments. • Final written exams.
1.2	Recall the molecular structure, methods of preparations, chemical and biological properties.		
1.3	Describe the main isolation and characterization techniques.		
1..			
2.0	**Skills**		
2.1	Write the methods of preparing the natural molecules.	• Lectures • Debate and discussion Working in small groups • Individual & group assignments	• Quizzes • Midterm exam. • Assignments. • Final written exams.
2.2	Use knowledge to solve chemical problem related to the concepts.		
2..			
3.0	**Competence**		
3.1	Cooperate with his colleagues in teamwork searching of recent papers in the field of plant drug discovery to get insight into the application of natural products.	The classroom strategy of student-teacher and student-student discussions and problem-solving and assignments encourages the development of these	*Participate in class discussions. *Evaluation of individual and group assignments.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		skills. .	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments & Activities	During Semester	10
5	Final Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	1. Biochemistry & Molecular Biology of Plants, B. Buchanan, W. Gruissem, R. Jones, Eds.2000, American Society of Plant Physiologists. 2. Biologically active natural products: pharmaceuticals. CRC Press. p. 5. Cutler, Stephen J.; Cutler, Horace G. (2000). ISBN 978-0-8493-1887-0. AOAC,(2005) Association of Official Analytical Chemists, 3. Natural Products Chemistry for Drug Discovery, Stephen Neille et. al (editors)
Essential References Materials	Klein, David R. "*Organic Chemistry as a Second Language,* 2nd ed. ISBN 978-0-470-12929-6 {English edition} Natural Products Chemistry Sources, Separations and Structures, Raymond Cooper and George Nicola, Taylor & Francis Group, (2015).
Electronic Materials	• http://www.sbcs.qmul.ac.uk/iupac/sectionF/https://study.com/academy/lesson/alkynes-properties-uses-formula-examples.html . • http://en.wikipedia.org/wiki/Natural_product • http://semmelweis.hu/farmakognozia/files/2015/11/Terpenoids-2015-11.pdf • www.khalidshadid.com/.../chapter_-1_chemistry_of_natural_prod • https://pdfs.semanticscholar.org/177c/4ab652dafedbfcd8bc8c64ca0ad9081cfca8.pdf

	• www.ag.unr.edu/Cramer/Poisonplants_files/Poisonplants.ppt • www.ag.unr.edu/Cramer/Poisonplants_files/Poisonplants.ppt • https://www.bioc.cam.ac.uk/leadlay/pfl-group/polyketide-biosynthesis
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms equipped with smart board and display screen for (40) students •
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Organic Synthesis**
Course Code:	**31021446**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours: 3 credit hrs. (2T + 1P)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: Level 8, fourth year
4. Pre-requisites for this course (if any)**:** Organic Chemistry 2 (31021222)
5. Co-requisites for this course (if any)**:** none

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	60

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Lectures: This course is designed to give a broad overview of organic synthesis, with respect to, aldol condensation, Acylation of primary amines and phenols, Carbonyl addition, Benzoin condensation, Aromatic Oxidation reactions, Rearrangement, Synthesis of Dilantin (epilepsy drug), Azo Dye and Stereochemistry.

Labs: The labs will provide student with an opportunity to synthesize of Acetanilide, Aspirin, Dibenzalacetone, Benzalacetophenone, Acetophenone Oxime, Benzoin, benzil, Benzilic acid, *p*-aminoazobenzene, Dilantin, *p*-nitroaniline, *p*-nitroaniline, Para Red and Fumaric acid .

2. Course Main Objective

The objectives of this course are to:

1- Introduce students to the basic concepts of organic synthesis and some reaction mechanisms.

2- Expose students to the knowledge of using lab available reagents in organic synthesis and calculate the reaction mass balance, propose reaction mechanism, calculate the theoretical yield and % of yield.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recall the most known name reactions in organic synthesis.	1.2
1.2	Explain the mechanisms of the name reactions in organic synthesis.	1.3
1..		
2	**Skills :**	
2.1	Suggest mechanistic pathways for some named reactions.	2.1
2.2	Apply creative thinking in providing innovative solutions to the chemical problems calculating the mass balance, theoretical and actual yields of the reaction products.	2.2
2.3	Conduct laboratory experiments by using different techniques and different spectroscopic techniques to identify the reaction products.	**2.4**
2..		
3	**Competence:**	
3.1	Bear self-learning responsibility and decision-making.	3.1
3.2	Write lab reports of experiments done in the lab.	3.3

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to the course. **Acylation of primary amines and phenols**: Synthesis of Acetanilide and Aspirin, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the products, recrystallization and determination of the MP.	4
2	**Aldol condensation:** Synthesis of Dibenzalacetone and Benzalacetophenone, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the products, , recrystallization and determination of the MP..	4

3	**Carbonyl addition** (Shiff's base): Synthesis of Acetophenone Oxime, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR, MS spectra of the product, recrystallization and determination of the MP.	3
	Exam 1	1
4	**Benzoin condensation**: reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR and MS spectra of the product, recrystallization and determination of the MP.	2
5	**Aromatic Oxidation reactions**: Synthesis of Benzil, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the product, recrystallization and determination of the MP.	2
6	**Rearrangement reactions**: synthesis of Benzilic acid and *p*-aminoazobenzene, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the product, recrystallization and determination of the MP.	4
	Mid Term Exam	**1**
7	**Drug design**: Synthesis of Dilantin: reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the product, recrystallization and determination of the MP.	2
8	**Nitration reaction:** Indirect of aniline synthesis of *p*-nitroaniline: reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the products.	2
9	**Azo Dye:** synthesis of Para Red, reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the product.	2
10	**Stereochemistry (cis - trans):** Synthesis of Fumaric acid from Maleic acid: reaction mechanism, calculation of the theoretical yield and % yield and study the IR, ^{1}H NMR spectra of the product.	3
	Exam 2	**1**
	Final lab exam	
	Final Exam	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recall the most known name reactions in organic synthesis.	• Lectures • Debate and discussion • Working in small groups. • Individual and group assignments	• Quizzes. • Midterm exam • Evaluation of assignments. • Final written exams.
1.2	Explain the mechanisms of the name reactions in organic synthesis.		
1..			
2.0	**Skills**		
2.1	Suggest mechanistic pathways for some named reactions.	• Lectures • Debate and discussion	• Quizzes. • Midterm exam • Evaluation of
2.2	Apply creative thinking in providing		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	innovative solutions to the chemical problems calculating the mass balance, theoretical and actual yields of the reaction products.	• Working in small groups. Individual and group assignments	assignments. Final written exams.
2.3	Conduct laboratory experiments by using different techniques and Different spectroscopic techniques to identify the reaction products.	• Laboratory sessions • Debate and discussion. • Working in small groups • Individual & group lab work.	*Lab reports *Final lab exam
3.0	**Competence**		
3.1	Bear self-learning responsibility and decision-making.	• Team work • Small groups and the distribution of roles. • PowerPoint presentation. • Writing reports	Oral discussion Report evaluation Observation cards
3.2	Write lab reports of experiments done in the lab.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	5
2	Midterm Theoretical Exam	9	10
3	Quiz2	13	5
4	Assignments and Activities	During Semester	10
5	Final Practical Exam	16	10
6	Lab Reports	During Semester	10
7	Final Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	TEXTBOOK OF PRACTICAL ORGANIC CHEMISTRY(Vogel's), 5th Ed., B. S. FURIYIS, A. J. HANNIAFORD, P. W. *G.* SMITH, A. R. TATCHELL, John Wiley & Sons, Inc., New York (*1989).*

Essential References Materials	Klein, David R. "*Organic Chemistry as a Second Language,* 2nd ed. ISBN 978-0-470-12929-6 {English edition}
Electronic Materials	• http://www.orgsyn.org/ . • http://www.organic-chemistry.org/namedreactions/aldol-condensation.shtmhttp://www.organic-chemistry.org/namedreactions/benzoin-condensation.shtm. • https://en.wikipedia.org/wiki/Para_red . • https://en.wikipedia.org/wiki/Phenytoin • https://www.masterorganicchemistry.com/2011/10/17/introduction-to-rearrangement-reactions/. • http://www.orgsyn.org/demo.aspx?prep=CV2P0163. • https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay.
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms equipped with smart board and display screen for (40) students • Practical labs provided with glass wares, reagents, melting point apparatus and different equipment for (20-25) students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• TLC gars. • Glass tubes. • A sensitive balance Chemicals

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Polynuclear Aromatic Compounds**
Course Code:	**31021452**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours: 3 credit hrs. (3T)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: Level 8, fourth year
4. Pre-requisites for this course (if any)**:** Organic Chemistry 2 (31021222)
5. Co-requisites for this course (if any)**:** none

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	75

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

- **Lectures:** This course is designed to give a broad overview of polynuclear hydrocarbon chemistry, with respect to, classification, nomenclature, synthesis and reactions of of biphenyl, Terphenyls, Fluorene, Diphenic acid, Diphenylmeyhane, Triphenylmethane, Triphenylcarbinol, Triphenylmethyl chloride,naphthalenes, Anthracene, Phenanthrene, Tetracene, Picene and Pyrene. The course encompasses: optical activity of biphenyl and Molecular Overcrowding, Carcinogenic hydrocarbons.

2. Course Main Objective

The objectives of this course are to:

1- Introduce students to the basic concepts of polynuclear hydrocarbon chemistry, classification, characteristics, synthesis, reactions and their structure..

2- Give students a broad perception to define the fundamentals of polynuclear hydrocarbons and Molecular Overcrowding, Carcinogenic hydrocarbons.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the fundamentals concepts of polynuclear hydrocarbons, importance, their classes, the names, and synthetic methods.	1.1
1.2	Describe in details the most important chemical reactions and uses.	1.2
1.3	Define the optical activity of biphenyl and molecular overcrowding, carcinogenic hydrocarbons	1.3
1.4		
2	**Skills :**	
2.1	Recall the names, methods of preparation, and their chemical reaction.	2.1
2.2	Apply his knowledge in solving chemical problems.	2.2
2.3		
3	**Competence:**	
3.1	Bear self-learning responsibility and decision-making in solving problems and serving the community..	3.1
3.2		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and nomenclature of polynuclear hydrocarbons.	3
2	Classification of polynuclear hydrocarbons.	3
3	Isolated System: biphenyl, synthesis, optical activity, Structure Racemization, Atropisomerism of substituted biphenyl.	6
4	Reactions of biphenyl.	3
	Exam 1	1.5
5	Related compounds: Terphenyls, Fluorene, Diphenic acid, Diphenylmeyhane, Triphenylmethane, Triphenylcarbinol, Triphenylmethyl chloride, Synthesis and reactions.	4.5
6	CONDENSED SYSTEM: Naphthalene, Structure, Synthesis, Production, Nomenclature of naphthalenes, Reactions of naphthalene	3

7	. Substituted naphthalene: Orientation of electrophilic substitution in naphthalene derivatives, Naphthalene as a chemical intermediate	3
	Mid Term Exam	1.5
8	Anthracene: Structure, Synthesis and Reactions,	3
9	Preparation of anthracene derivatives: Anthraquinone, preparation and reactions.	3
10	Alizarin: Structure, Properties, Alizarin orange.	3
	Exam 2	1.5
11	Phenanthrene and Phenanthraquinone: Structure, Synthesis and Reactions.	1.5
12	Higher Condensed Aromatic hydrocarbons: Tetracene. 1,2-Benzanthracene: 1,2,5,6-Dibenzanthracene, 20-Methylcholanthracene, 1,2-Benzphenanthrene (Chrysene): 1,2,6,8-Dibenzphenanthrene (Picene), Pyrene: 1,2-Benzpyrene; properties and synthesis.	3
13	Molecular Overcrowding, Carcinogenic hydrocarbons	1.5
	Final Exam	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the fundamentals concepts of polynuclear hydrocarbons, importance, their classes, the names, and synthetic methods.	• Lectures • Individual & group assignments. • homework	Quizzes Midterm exam. Assignments. Final written exams.
1.2	Describe in details the most important chemical reactions and uses.		
1.3	Define the optical activity of biphenyl and molecular overcrowding, carcinogenic hydrocarbons		
2.0	**Skills**		
2.1	Recall the names, methods of preparation, and their chemical reaction.	• Lectures • Debate and discussion. • Cooperative Learning • Working in small groups Individual & group assignments	• Evaluation of assignments and homework. • Quizzes • Midterm exam. Final written theoretical exam.
2.2	Apply his knowledge in solving chemical problems.		
3.0	**Competence**		
3.1	Bear self-learning responsibility and decision-making in solving problems and serving the community.	-Individual and team work Assignments -student presentation and reporting.	• Evaluation of individual & group works.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Theoretical Exam	9	20
3	Quiz2	13	10
4	Assignments and Activities	During Semester	10
5	Final Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.
- Arrange extra hours gifted students or Program for students who default in scholastic achievement.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	I. L.Finer "Organic Chemistry" Vol. 1, 6th Ed., Longman House, Burnt Mill, Harow, Esswt, U. K.
Essential References Materials	A. N. Nesmeyanov and N. A. Nesmeyanov " Fundamentals of Organic Chemistry" Vol. 3, Mir Publishers, Moscow (1977).
Electronic Materials	• https://en.wikipedia.org/wiki/Polycyclic_aromatic_hydrocarbon. https://www.britannica.com/science/polycyclic-aromatic-hydrocarbon There are also YouTube sites and animation can be found, including • https://www.youtube.com/watch?v=wYg-8ElG47c. • https://www.youtube.com/watch?v=k2trWKzUWg4
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms equipped with smart board and display screen for (40) students •
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory	

Item	Resources
equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Materials Science**
Course Code:	**31021421**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours:	**3**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh**
4. Pre-requisites for this course (if any):	**Inorganic Chemistry II (31022204) and Organic Chemistry II (31022202)**
5. Co-requisites for this course (if any)**: --** None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	36	80.00%
2	**Blended**	9	20.00%
3	**E-learning**		
4	**Correspondence**	--	--
5	**Other**	--	--

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	--
3	**Tutorial**	--
4	**Others** (specify)	--
	Total	45
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others**(specify)	
	Total	75

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This is an introduction course to material science. Basic atomic and electronic structure of solids including metals, polymers, ceramics, and semiconductors are studied. Defects,

imperfections, X-ray diffraction, and phase diagrams are used as a basis for understanding mechanical/electrical properties.

2. Course Main Objective

-This course concerns with the application of theories of statistics, which consists of a set of mathematical tools to deal with the huge gatherings, within the field of mechanics who cares about the movement of particles or objects when subject to external forces. So believe in statistical mechanics framework to link the microscopic properties microscopic properties of atoms and molecules with the properties of the phenomenon macroscopic properties of materials studied.

-Understanding the nature of the crystal, its characteristic features including spectroscopic properties, the crystalline state and its imperfections comprising such topics as static phenomena, magnetic and electrical properties, conductors and semi-conductors.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the terms and basic concepts in material Science.	1.1
1.2	Identify the symbols, examples and properties of materials.	1.2
1.3	Classify the principles and theories related to types of materials.	1.3
2	**Skills :**	
2.1	Design for explaining the different types of materials and their process.	2.1
2.2	Recognize different methods of preparations and application of materials.	2.2
3	**Competencies**	
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in understanding material structures and their applications in serving the community.	3.1
	Bear self-learning responsibility and decision-making.	3.2

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to the Course	1
2	Review of Atomic Bonding in solids, and the Relationship of Bonding to Structure, of Structure to Properties; Bond Energy	2
3	Structures of Crystalline Solids: Unit Cells and Lattices; Calculation of Theoretical Density; Crystallographic terms; X-Ray Diffraction	6
4	Microscopic Properties of Crystalline Solids: Imperfections (Defects) and Dislocations	3
5	Motion in Crystalline Solids: Modes and Energies of Diffusion	3

6	Macroscopic Properties: Stress and Strain as Engineering Concepts; Testing for stress and strain; Concept of moduli, elastic and linear; Bend Test; Brinnel Test	6
7	Failure of Materials	3
8	Phase Diagrams: Equilibrium effects and Non-equilibrium phenomena	3
9	Fundamental Materials: Steel, Non-ferrous metals, Alloys & Ceramics	9
10	Organic Materials: Polymers. Polymer formation; Polymer structure—bonding & branching; Polymer configuration and conformation	3
11	Polymer mixtures, blends and composites	3
12	Polymer Processing	3
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1	**Knowledge:**		
1.1	Define the terms and basic concepts in material Science	- Lectures - Short cognitive tests - Quarterly tests - Assignments and discussions within the lecture	Since understanding is emphasized instead of memorization, open-book exams are recommended. *Quizzes *Final Exam
1.2	Identify the symbols, examples and properties of materials		
1.3	Classify the principles and theories related to types of materials.		
2	**Skills**		
2.1	Design for explaining the different types of materials and their process.	- Questions and exercises - Assignments, -discussion and dialogue - Lectures - Exercises and applications - Problem solving method .	- Oral tests - Written tests - Solve problems - Practical tests - Evaluation of reports and assignments.
2.2	Recognize different methods of preparations and application of materials.		
3	**Competence**		
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in understanding material structures and their applications in serving the community.	- Lectures - Self learning - Activities and assignments - Presentations - Individual and group research	- Theoretical and practical examinations - Evaluation of projects and assignments - Exercises and applications - Evaluation of presentations
3.2	Bear self-learning responsibility and decision-making.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments	6-14, as needed	20%
2	Exam 1	6	15%
3	Exam 2	11	15%
4	Final exam	Last week of semester	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Faculty are expected to be available for in-person consultation a *minimum* of 5 hours weekly; additional access to faculty consultation by students *via* electronic media (e.g., email or a discussion board) is highly recommended, but must be arranged in accord with the individual faculty member's other professional and personal obligations and in light of other academic and personal commitments students have. However, because this course is designed with a significant portion of out-of-class work, it will be especially important that serious consideration be given by the faculty member to maximizing modes and opportunities for communicating with students

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Shackelford, James F.; *Introduction to Materials Science for Engineers*, 7th Edition, NY: Pearson Prentice Hall, (2009); ISBN
Essential References Materials	(1) Callister, W.D.,Jr., *Materials Science and Engineering: An Introduction*, 7th Ed., NY: Wiley and Sons, 2006; ISBN-10: 0-471-73696-1 (2) Cahn, Robert W., Kramer, E. J., and Haasen, Peter, Eds.; *Material Science and Technology: A Comprehensive Treatment*, NY: Wiley-VCH, 2005; ISBN-13: 9783527313952
Electronic Materials	(1) *The Open Materials Science Journal*http://www.bentham.org/open/tomsj
Recommended Books and Reference Material (Journals, Reports, etc)	(1) Gerold, Volkmar, Ed; *Materials Science and Technology* , Vol. 1, Structures of Solids, NY:Wiley- VCH, 1996, ISBN: 3-527-26814-6 (2) Kaufmann, Elton N.; *Characterization of Materials*, [2 Volume Set]; NY: Wiley, 2003, ISBN-10: 0471268828 (3) Cahn, Robert, Ed.; *Concise Encyclopedia of Materials*

	Characterization, 2nd Ed.; (Advances in Materials Science and Engineering), Amsterdam: Elsevier, 2004, ISBN-10: 0-08-044547-0 (4) *Journal of Materials Science* (5) *Journal of Materials Science and Technology (China)* (6) *Advanced Materials* (Journal) (7) *Advanced Composite Materials* (Journal) (8) *Materials Today* (Journal (9) *Science and Technology of Advanced Materials* (Journal) (10) *Chemistry of Materials* (Journal)

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room with tables and/or movable chairs for student group work
Technology Resources (AV, data show, Smart Board, software, etc.)	In class computers would allow for online tests rather than paper and pencil, but this is not essential
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	--

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Biochemistry (2) (Elective course 2)**
Course Code:	**31021450**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours: 3 credit hours
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: 8th level /4th year
4. Pre-requisites for this course (if any)**: Biochemistry I (31021327)**
5. Co-requisites for this course (if any)**:** none

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	60

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to give a broad overview of the foundations of biochemistry, with an emphasis on organic chemistry. Topics include: Photosynthesis, photosynthesis and carbohydrate biosynthesis.

Discuss the structure, digestion, absorption, and metabolism of carbohydrates (**Glycolysis**), lipids(**BetaOxidation**), proteins, Urea Cycle,Metabolic Function of Liver, Nucleotides Metabolism and Metabolic Interrelations

2. Course Main Objective

The objectives of this course are to:

- To give the students a broad overview of Biochemistry.
- Expose students to the knowledge and understanding of Photosynthesis, correlating photosynthesis and carbohydrate biosynthesis
- Give students a broad perception to Discuss the digestion, absorption, and metabolism of carbohydrates, proteins, Amino acids and lipids
- Give students a broad perception to define catabolism and anabolism, and understand amino acid nitrogen disposal
- Explain the steps of Metabolism of Carbohydrates: in Glycolysis, Krebs cycle and Electron Transfer Chain during the citric acid cycle, electron transport chain, gluconeogenesis, lipid metabolism (Beta Oxidation), Protein Metabolism , Urea Cycle, amino acid metabolism, and nucleotide metabolism

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define some basic terms used in biochemistry, Photosynthesis, Digestion, Absorption, Gluconeogenesis, and Biological oxidation, etc.	1.1
1.2	Recall the different diagram using different metabolic cycles.	1.2
1.3	Explain the Metabolic pathway of different metabolites.	1.3
1.4		
2	**Skills :**	
2.1	Interpret the mechanism of different metabolic pathway in the living organism.	2.1
2.2	Explain the role of different parts of the living organism and their functions in the regulations of metabolism (Anabolism and Catabolism).	2.2
2.3		
3	**Competence:**	
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in solving chemical problems and serving the community.	3.1
3.2	Bear self-learning responsibility and decision-making.	3.2

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to the course; photosynthesis	3

2	Photosynthesis, continues; correlating photosynthesis and carbohydrate biosynthesis	1
3	Digestion and Absorption: Digestion of Carbohydrates	1
4	Biological Oxidation	3
5	Metabolism of Carbohydrates: Glycolysis	3
6	Gluconeogenesis	3
7	Diabetes Mellitus	2
8	Digestion and Absorption of Lipids	1
9	Lipids Metabolism (Beta Oxidation)	3
10	Lipogenesis	2
11	Digestion and Absorption of Proteins	1
12	Protein Metabolism	3
13	Urea Cycle	2
14	Synthesis of Eicosanoids	1
15	Nucleotides Metabolism	3
16	Metabolic Interrelations	3
17	Metabolic Function of Liver	1
18	Minerals Metabolism	3
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define some basic terms used in biochemistry, Photosynthesis, Digestion, Absorption, Gluconeogenesis, and Biological oxidation, etc.	• Lectures • PowerPoint presentation • Debate and discussion. • Cooperative Learning • Working in small groups *Individual & group assignments	• Evaluation of assignments. • Quizzes • Midterm exam. *Final written exams.
1.2	Recall the different diagram using different metabolic cycles.		
1.3	Explain the Metabolic pathway of different metabolites.		
1.4			
2.0	**Skills**		
2.1	Interpret the mechanism of different metabolic pathway in the living organism.	• Lectures • Debate and discussion. • Cooperative Learning • Working in small groups Individual & group assignments.	• Evaluation of assignments. • Quizzes • Midterm exam. • *Final written exams.
2.2	Explain the role of different parts of the living organism and their functions in the regulations of metabolism (Anabolism and Catabolism).		
2.3			

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence**		
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in solving chemical problems and serving the community.	**Team work-Assignments-student presentation-reporting. **Co-operative & Individual assignments. .	**Evaluation of individual & group works. **Observation Card
3.2	Bear self-learning responsibility and decision-making.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quiz 1	5	10
2	Midterm Written Theoretical Exam	9	20
3	Quiz 2	13	10
4	Assignments	During Semester	10
5	Final Written Theoretical Exam	17	50
			100

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Nelson, David and Michael Cox, Lehninger *Principles of Biochemistry*, 5th ed., 2008, [*Chapters 19 – 28*], NY: W.H. Freeman Publishers, Inc. ISBN: 0-7167-7108-X
Essential References Materials	(1) On-line 'CourseSmart' companion material to the text accessed at http://www.coursesmart.com/9780716771081 (2) Osgood, M. And Ocorr, K.; *Absolute, Ultimate Guide to Lehninger Principles of Biochemistry: Study Guide and Solutions Manual*, 5th ed., MY:McMillan Publishing Co., 2008, ISBN:1429212411
Electronic Materials	• http://www.peoi.org/Courses/Coursesen/biochem/biochem18.html. • https://en.wikipedia.org/wiki/Carbohydrate_digestion. • http://www.1life63.com/en/omega-in-your-body-digestion-of-lipids/digestion-of-lipids. • https://www.ncbi.nlm.nih.gov/books/NBK22600/.

Other Learning Materials	**There are also YouTube sites and animation can be found, including** • https://www.youtube.com/watch?v=oB4TWdU5fw4. • https://www.youtube.com/watch?v=nUejBDRtuKQ. • https://www.youtube.com/watch?v=GrmRmBdC9ug http://themedicalbiochemicalpage.org • http://www.bio.cmu.edu/Courses/BiochemMols/BCMolecules.html • http://www.coursesmart.com/9780716771081 • http://themedicalbiochemicalpage.org • http://pymol.sourceforge.net • http://delsci.con/ep • , http://www.roberts-publishers.com

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms equipped with smart board and display screen for (40) students
Technology Resources (AV, data show, Smart Board, software, etc.)	Provision of computers for students training to be used in research on scientific topics that serve the course.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Coordination Chemistry**
Course Code:	**31021442**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Albaha University**

Table of Contents

A. Course Identification

1. Credit hours: 2 credit hours
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 8th level /4th year
4. Pre-requisites for this course (if any)**:** Inorganic Chemistry (2) (3101224)
5. Co-requisites for this course (if any)**:** None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	30
Other Learning Hours*		
1	Study	30
2	Assignments	15
3	Library	15
4	Projects/Research Essays/Theses	15
5	Others (specify): web search	
	Total	75

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course includes the following topics: introduction to coordination complexes, bonding in metal complexes, electronic structure of coordination compounds, and reactivity of complexes in solution, symmetry and point group. Some special topics in coordination chemistry including metal-metal bonding and the importance of coordination in biochemical processes.

2. Course Main Objective

1- Knowledge of basic concepts and principles of coordination chemistry and symmetry.
2- To introduce the students into bonding in coordination compounds, isomerism in metal complexes and bonding theories.
3- To introduce Students to characterization of coordination compounds using spectroscopic methods.
4- To provide students with basic knowledge of applications of coordination compounds.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Define the concepts, terms and basic principles in coordination Chemistry and symmetry.	1-1
1.2	Recall formulas, chemical equations and reactivity of metal complexes.	1-2
1.3	Explain key principles and theories to describe structure and bonding in coordination compounds.	1-3
1...		
2	**Skills :**	
2.1	Apply creative thinking in interpreting bonding and structure of coordination compounds, behavior and their importance.	2-2
2.2	Use spectroscopic techniques and methods in structure determination of coordination compounds.	2-3
2...		
3	**Competence:**	
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in solving chemical problems related to coordination chemistry.	3-1
3.2	Bear self-learning responsibility and decision-making	3-2
3...		

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to Coordination complexes**: Coordination number and geometry and bonding, structural foundations of co-ordination complexes, Ligand types (monodentate and polydentate) and coordination modes, chelation and Chelate effect, HSAB (hard and soft acids and bases), stability.	6
2	**Bonding in co-ordination complexes**: To describe structure and bonding in co-ordination complexes using: (i) Valence bond theory, (ii) Ligand Field Theory (iii) Crystal field theory , (iv) Molecular orbital theory	6
3	**Electronic structure of co-ordination complexes**: electronic absorption spectra and magnetic properties of co-ordination compounds.	2
4	**Electronic structure of co-ordination complexes**: electronic absorption spectra and magnetic properties of co-ordination compounds.	4
5	Mid-term exam	2

6	**Symmetry and Point Groups**. Determination of symmetry elements and operations; molecular point group determination; symmetry and dipole moment and chirality.	4
7	Spectroscopy of inorganic complexes.	2
8	**Special Topics in Coordination Chemistry**. Metal-Metal Bonds; Solar Energy Conversion.	2
9	Importance of coordination chemistry to many biochemical processes	2
10	* Final exam	
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the concepts, terms and basic principles in coordination Chemistry and symmetry.	* Lectures * Discussion questions during class * Assignments	* Short quizzes * Mid-term exam * Final exam *Individual assignments
1.2	Recall formulas, chemical equations and reactivity of metal complexes.		
1.3	Explain key principles and theories to describe structure and bonding in coordination compounds.		
2.0	**Skills**		
2.1	Apply creative thinking in interpreting bonding and structure of coordination compounds, behavior and their importance.	* Lectures * Discussion questions during class * Assignments	* Short quizzes * Mid-term exam * Final exam *Individual and group assignments
2.2	Use spectroscopic techniques and methods in structure determination of coordination compounds.		
3.0	**Competence**		
3.1	Cooperate with his colleagues in teamwork and actively collaborate within one team in solving chemical problems related to coordination chemistry.	* Lecture preparation * Discussions * solving problems	Monitoring individual behavior during the class and group work.
3.2	Bear self-learning responsibility and decision-making		
3.3			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exam 1	5	10%
2	Mid-term Exam	9	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	Exam 2	13	10%
4	Assignments	During semester	10%
5	Final exam	17	50%
8	Total		100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Recommend faculty have 2 hours per week office hours available for student appointments.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- Introduction to Coordination Chemistry. 1st edition, 2013. Geoffery A. Lawrance. Wiley. 2- Inorganic Chemistry, Principles of structure and reactivity, 4th edition. J.E.Huheey and others. 3-Inorganic Chemistry (4th edition); Catherine E. Housecroft and Alan G. Sharpe. Pearson (2012).
Essential References Materials	1- Advanced Inorganic Chemistry (6th edition), Cotton, F. Albert; Wilkinson, G.; Murillo, C. A. (1999); New York: Wiley-Interscience (ISBN 978-0-471-19957-1 - John Wiley & Sons)
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	* Lecture room with tables and/or movable chairs for student group work * Laboratory for experimentation
Technology Resources (AV, data show, Smart Board, software, etc.)	* Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Glassware, chemicals and ordinary laboratory equipment for practical part

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching strategies.	Students	Direct Students feedback/ survey
Course contents and Learning resources	Students, Faculty and external reviewer.	Direct
Verifying Standards of Student Achievement	Independent member teaching staff	Direct, check marking and assessment methods. Analyzing results of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Course Specifications

Course Title:	**Chemistry of Metals Extraction and Corrosion**
Course Code:	**31021454**
Program:	**Bachelor of Science in Chemistry**
Department:	**Chemistry**
College:	**Faculty of Science**
Institution:	**Al Baha University**

Table of Contents

A. Course Identification

1. Credit hours: **3 credit hours**
2. Course type **a.** University ☐ College ☐ Department √ Others ☐ **b.** Required ☐ Elective √
3. Level/year at which this course is offered: 8th Level, Fourth year
4. Pre-requisites for this course (if any)**: Inorganic chemistry -II (31021224)**
5. Co-requisites for this course (if any)**: None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	
3	**Tutorial**	
4	**Others** (specify)	
	Total	45
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	75

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is divided into two sections: The first section addresses introduction to extraction of metals, methods of extraction and the various factors which influence the choice of method for extracting metals from their ores, including reduction by carbon, reduction by a reactive metal (like sodium or magnesium), and by electrolysis. Details for the extraction of aluminum, copper, iron and titanium.
The second section will cover fundamentals of Corrosion: Introduction to electrochemical principles and their application to corrosion of materials and corrosion control. Thermodynamics and kinetics of corrosion, corrosion mechanisms, corrosion inhibition and electrochemical protection of metals. Corrosion types: pitting, crevice, inter-granular, galvanic, and stress-corrosion cracking. Real-world case studies from Saudi oil and gas production and processing industries.

2. **Course Main Objectives**

1- This course is designed to give the students a fundamental knowledge on extraction of metals from their ores.
2- Provide the students with details knowledge on methods and techniques used for extraction of some common metals.
3- To give the students a basic understanding of corrosion phenomena, corrosion types and the application of electrochemical methods to corrosion of metals and corrosion inhibition.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the Methods of extraction and the various factors which influence the choice of method for extracting metals from their ores.	1.1
1.2	Understand the processes of extraction at macro scales and conversion of metals to alloys. Definition of corrosion and the factor affecting the rate of corrosion.	1.2
1.3	Explain different experimental methods of determination of the corrosion of materials and corrosion control.	1.3
1...		
2	**Skills :**	
2.1	Derive the mathematical equations and analyze the components and units.	2.1
2.2	Identify the corrosion mechanisms and differentiate between corrosion types.	2.2
2.3	Use experiments to demonstrate metal extraction and corrosion	2.3
2.4		
3	**Competence:**	
3.1	Work effectively in groups and exercise leadership when appropriate.	3.1
3.2	Act responsibly in personal and professional.	3.2
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to extraction of metals	3
2	occurrence of metals in nature	3
3	Metallurgy	3
4	concentration of ores	3
5	basic metal extraction principles and terminology	3
6	methods of extraction of metals from their ores,	3
7	purification of the metals extracted,	3
8	powder metallurgy	3
9	some examples of extraction of metals,	3
10	principles of corrosion and oxidation,	3
11	High temperature corrosion	3
12	effect of mechanical factors on corrosion,	3
13	corrosion inhibitors	3
14	cathodic and anodic protection, treatment of metal finishing, ,methods of protection	3
15	corrosion testing	3
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the Methods of extraction and the various factors which influence the choice of method for extracting metals from their ores.	* Lectures * Discussion questions during class * Assignments	*Short quizzes * Mid-term exam * Final exam *Individual assignments
1.2	Understand the processes of extraction at macro scales and conversion of metals to alloys. Definition of corrosion and the factor affecting the rate of corrosion		
…	Explain different experimental methods of determination of the corrosion of materials and corrosion control		
2.0	**Skills**		
2.1	Derive the mathematical equations and analyze the components and units.	* Lectures	Short quizzes * Mid-term exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Identify the corrosion mechanisms and differentiate between corrosion types	* Discussion questions during class * Assignments	* Final exam *Individual and group assignments
…	Use experiments to demonstrate metal extraction and corrosion	Laboratory sessions	Lab reports Final laboratory exam.
3.0	**Competence**		
3.1	Work effectively in groups and exercise leadership when appropriate.	* Lecture preparation * Discussions * solving problems	Monitoring individual behavior during the class and group work.
3.2	Act responsibly in personal and professional.		
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exam 1	5	10%
2	Mid-term exam	9	20%
3	Exam 2	13	10%
4	Assignments	During semester	10%
5	Final Exam	17	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: (include amount of time teaching staff are expected to be available each week)

Faculty are expected to be available for in-person consultation a *minimum* of 5 hours weekly; additional access to faculty consultation by students *via* electronic media (e.g., email or a discussion board) is highly recommended, but must be arranged in accord with the individual faculty member's other professional and personal obligations and in light of other academic and personal commitments students have.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Handbook of Extractive Metallurgy, FatbiHabashi, , WILEY-VCH 1997
Essential References Materials	1- Chemical Metallurgy, Principles and Practice, Chiranjib Kumar Gupta, 2003 Wiley-VCH Verlag GmbH & Co. ,KGaA Weinheim

	2- Extraction of Metals from Soils and Waters (Modern Inorganic Chemistry) ; D. Max Roundhill ; Springer (2010); ISBN-10: 1441933786, ISBN-13: 978-1441933782. 3- The Extraction and Refining of Metals (Materials Science & Technology); by: Colin Bodsworth ; CRC Press; 1 edition (1994); ISBN-10: 0849344336, ISBN-13: 978-0849344336 4- Introduction to Corrosion Science; Edward McCafferty; Springer; 1st Edition. edition (2010); ISBN-10: 1441904549, ISBN-13: 978-1441904546. 5- Corrosion Chemistry; by: Volkan Cicek and Bayan Al-Numan; Wiley-Scrivener; 1 edition (2011); ISBN-10: 0470943076, ISBN-13: 978-0470943076
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	* Lecture room with tables and/or movable chairs for student group work.
Technology Resources (AV, data show, Smart Board, software, etc.)	* Smart Board, Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
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