



Course Specifications

Course Title:	Chemistry of Catalysis	
Course Code:	4023563-3	
Program:	Chemistry / Industrial Chemistry	
Department:	Chemistry Department	
College:	Applied Science	
Institution:	Umm Al-Qura University	

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A. Course Identification

1. Credit hours: 3
2. Course type a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/> b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
3. Level/year at which this course is offered: 7th /4
4. Pre-requisites for this course (if any): NA
5. Co-requisites for this course (if any): NA

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	74%
2	Blended		
3	E-learning	√	26%
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	22
2	Laboratory/Studio	30
3	Tutorial	--
4	Others (E-learning + Exams + office hours)	15
	Total	67

B. Course Objectives and Learning Outcomes

1. Course Description

- The theoretical part includes introduction to catalysis, and its terminology and the methods of catalysts preparation. Homogeneous and heterogeneous catalysis. The student also will study the most recent spectroscopic and microscopic tools of catalyst characterization. Also, the student will study some applications of catalytic process
- The practical part contains some practical experiments using different techniques to understand the role of catalyst in the reaction and to study the effect of different parameters on catalysis

2. Course Main Objective

At the end of this course the student will be able to:

- Catalysis, its terminology, importance
- Types of catalysis
- Role of catalysts in reaction

- Catalytic reactors
- Applications of catalysis

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding	
1.1	Demonstrate broad knowledge and understanding of the underlying theories, principles, and concepts in catalysis.	K1
1.2	Identify characterization tools and chemical terminology in catalysis	K2
1.3	Discuss the research development, importance and uses of catalysts and their applications in our life	K3
2	Skills :	
2.1	Apply the theories, principles, and concepts in various contexts in catalysis chemistry.	S1
2.2	Solve complex problems related to catalysis chemistry.	S2
2.3	use and adapt practical experiments in catalysis chemistry	S3
2.4	interpret the characterization results of catalysts	S2
2.5	Communicate effectively using theoretical basis of catalysis chemistry to a variety of audiences	S4
2.6	Apply IT and communication technology in gathering and interpreting information and ideas concerning the catalysis chemistry.	S5
3	Values:	
3.1	Demonstrate commitment to professional and academic values and ethics	V1
3.2	Write and present a chemical report related to aliphatic chemistry.	V2
3.3	work individually and in a team to perform a specific experiment or preparing a report on the natural products chemistry	V3

C. Course Content

No	List of Topics	Contact Hours
1	Introduction to catalysis.	2
2	Some concepts and catalysis terminology (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)	4
3	Economic importance of catalysts. Methods of catalyst preparation	4+2E
4	Some spectroscopic and microscopic tools of catalyst characterization.	6
5	Examples include catalysts for oxidation, including pollution clean-up; hydrogenation including hydrogenation and refining processes	4+2E
6	Pollution control with particular reference to car exhausts	2+4E
7	Total	30
	Practical Part:	
1	Introduction	3

2	Catalytic Organic synthesis	3
3	Acetylation of Primary Amine (Preparation of acetanilide)	3
4	Study The Effect Of Temperature on The Catalytic Decomposition of H ₂ O ₂	3
5	Determination of Autocatalytic Part of The Reaction Between KMnO ₄ and Oxalic Acid	3
6	Electrophilic Aromatic Substitution Reaction- (Nitration of phenol)	3
7	Esterification and Transesterification Reactions	3
8	Catalytic Decomposition of H ₂ O ₂ Using MnO ₂ Solid Catalyst	3
9	Effect of Catalyst Amount on H ₂ O ₂ Decomposition Rate	3
10	Comparison Between Homogeneous and Heterogeneous Catalytic Decomposition of H ₂ O ₂	3
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 and Understanding		
1.1	Demonstrate broad knowledge and understanding of the underlying theories, principles, and concepts in catalysis.	Lectures	Mid-term and final written exams.
1.2	Identify characterization tools and chemical terminology in catalysis	Lectures	Mid-term, oral and final written exams.
1.3	Discuss the research development, importance and uses of catalysts and their applications in our life	Lectures E-Learning	Mid-term and final Exams Practical Lab exam Assignments and activities on blackboard
2.0	Skills		
2.1	Apply the theories, principles, and concepts in various contexts in catalysis chemistry.	Lectures Lab work E-Learning	Mid-term and final Exams Practical Lab exam Assignments and activities on blackboard
2.2	Solve complex problems related to catalysis chemistry.	Lectures Lab work	Mid-term and final Exams Practical Lab exam
2.3	use and adapt practical experiments in catalysis chemistry	Lectures Lab work	Mid-term and final Exams Practical Lab exam
2.4	interpret the characterization results of catalysts	Lectures	Mid-term, oral and final written exams.
2.5	Communicate effectively using theoretical basis of catalysis chemistry to a variety of audiences	Lab work	Practical Lab exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.6	Apply IT and communication technology in gathering and interpreting information and ideas concerning the catalysis chemistry.	Lab work	Practical Lab exam
3.0	Values		
3.1	Demonstrate commitment to professional and academic values and ethics	Lab work	Practical Lab exam
3.2	Write and present a chemical report related to aliphatic chemistry.	Lab work	Practical Lab exam
3.3	work individually and in a team to perform a specific experiment or preparing a report on the natural products chemistry		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	E-learning	All weeks	5%
2	Assignments and activities	All weeks	5%
3	Mid-term Exam	6	20%
4	Practical Lab Work (Reports and Exams)	11	30%
5	Final Exam.(2 hours exam)	12	40%

*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 :

- Presence of faculty members to provide consulting and advice.
- Office hours: during the working hours weekly, and the creation of appropriate means.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	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 2nd ed 2003, ISBN 3-527-30373-1
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	6. Catalytic Air Pollution Control: Commercial Technology, Johnson Matthey PLC, Orchard Road, Royston, Hertfordshire SG8 5HE, UK; 2010
Essential References Materials	http://en.wikipedia.org/wiki http://www.chemhelper.com/ http://www.chemweb.com
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	classroom capacity (50) students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Computer connected with Data show and TV
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Lab. With Equipment required for conducting catalytic experiments

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Program Leaders	Periodic review of final exams and the student's degrees in this course.
Extent of achievement of course learning outcomes.	Peer Reviewer	Checking selected exam papers, and student assignments.
Quality of learning resources	Students	Complete the questionnaire evaluation of the course in particular
Effectiveness of teaching and assessment	Program leader	Direct
Extent of achievement of CLO's	Peer Reviewer	Direct

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	

Head of Chemistry Department



Dr Moataz Morad

