

**Kingdom of Saudi Arabia**  
**The National Commission for**  
**Academic Accreditation & Assessment**



**Course Specifications**

**Kinetic Chemistry and Catalysis**

**402242-3**

### Course Specifications

Institution: <b>Umm Al-qura University</b>	Date of Report: <b>2015</b>
College/Department : <b>Faculty of Applied Science/ department of chemistry</b>	

#### A. Course Identification and General Information

1. Course title and code: <b>Kinetic Chemistry and Catalysis / 402242-3</b>			
2. Credit hours: <b>3 (2+1)</b>			
3. Program(s) in which the course is offered. <b>Chemistry program</b>			
4. Name of faculty member responsible for the course: <b>Dr.Tahani M. Bawazeer</b>			
5. Level/year at which this course is offered: <b>4<sup>rd</sup> level/2<sup>nd</sup> year</b>			
6. Pre-requisites for this course (if any): <b>Thermodynamics / 402241</b>			
7. Co-requisites for this course (if any)---			
8. Location if not on main campus: <b>both in El-Abdyah (boys side) and El-Zaher (girls side) and El-Azizia (girls side)</b>			
9. Mode of Instruction (mark all that apply)			
a. Traditional classroom	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
b. <b>Blended (traditional and online)</b>	<input checked="" type="checkbox"/>	What percentage?	<input type="checkbox" value="100%"/>
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
d. Correspondence	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
f. Other	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
Comments:			

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## B Objectives

<p>1. What is the main purpose for this course? By the end of this course the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Describe the principles of kinetic chemistry.</li> <li>2. Follow a reaction by different techniques.</li> <li>3. Determine the rate law from the experimental data.</li> <li>4. Analyze the experimental data of a given reaction.</li> <li>5. Write the sequence of the elementary steps "mechanism" of a reaction.</li> <li>6. Describe the fundamentals of catalysis and influence of the catalysts on the reaction rate.</li> </ol>
<p>2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)</p> <ol style="list-style-type: none"> <li>1. Encourage students to make reports in the field of kinetic chemistry from the library or using the Internet.</li> <li>2. Use the websites to follow up and update the new topics of the subject of the course.</li> </ol>

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## C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact Hours
General concepts in chemical kinetic – reaction rate – rate laws – reaction order – half-life time.	1	2
Factors affecting the rate of reaction.	1	2
Conventional techniques of following a reaction: chemical methods - physical methods.	2	4
Integration of simple rate laws: zero, first, second and third order reactions and examples.	1	2
Pseudo-first order reactions - fractional order reactions – higher order reactions and examples.	1	2
General revision and Mid-Term Exam.	1	2
Determining the rate law from experimental data: Isolation method - Differential methods - Integral methods – Method of Half lives.	1	2
Dependence of rate on temperature - The Arrhenius equation and activation energy.	1	2
Theories of chemical reactions - collision theory, transition-state theory.	1	2
Catalysis: types and examples.	1	2
Homogeneous catalysis - kinetics and mechanism of homogeneous catalysis	1	2
Theories of catalysis.	1	2
Catalysis by acids and bases and its applications.	2	4
General revision and Final Exam.	1	2

**Practical Part:**

1. Catalytic decomposition of hydrogen peroxide as a first order reaction.
2. Hydrolysis of ester as pseudo-first order reaction.
3. Saponification of ester as a second order reaction.
4. Persulfate-iodide reaction.
5. Oxidation of hydrogen peroxide to determine the order and the thermodynamic parameters.
6. Halogenation of acetone in solution as a zero order reaction.
7. Autocatalytic reaction between potassium permanganate and oxalic acid.

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	32	-	-	36	-	68
Credit	2	-	-	1	-	3

3. Additional private study/learning hours expected for students per week.

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
1.1	List the conventional techniques of following a reaction and select the appropriate one to the given reaction.	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Scientific discussion</li> <li>• Library visits</li> <li>• Web-based study</li> </ul>	<ul style="list-style-type: none"> <li>• Exams</li> <li>• web-based student performance systems</li> <li>• portfolios</li> <li>• long and short essays</li> <li>• posters lab manuals</li> </ul>
1.2	Mention the different reaction orders and their rate laws.		
1.3	Define the reaction rate constant of various reaction orders.		
1.4	List the factors affecting the reaction rate.		
1.5	Describe the types of catalysis - homogeneous catalysis.		
1.6	Explain the mechanism of catalysis by acids and bases.		

1.7	Describe the different theories of catalysis.		
<b>2.0</b>	<b>Cognitive Skills</b>		
2.1	Compare between the different experimental techniques of following a reaction.	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Scientific discussion</li> <li>• Library visits</li> <li>• Web-based study</li> </ul>	<ul style="list-style-type: none"> <li>• Exams</li> <li>• web-based student performance systems</li> <li>• portfolios</li> <li>• posters</li> <li>• demonstrations</li> </ul>
2.2	Solve the rate-law expressions for different reaction orders.		
2.3	Solve the kinetic problems for all orders.		
2.4	Give a concise interpretation of the mechanism of catalysis by acids and bases.		
<b>3.0</b>	<b>Interpersonal Skills &amp; Responsibility</b>		
3.1	Manage resources, time and collaborate with members of the group.	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Scientific discussion</li> <li>• Web-based study</li> </ul>	<ul style="list-style-type: none"> <li>• Exams</li> <li>• web-based student performance systems</li> </ul>
3.2	Use the library and internet for collecting information and search about different topics.		
<b>4.0</b>	<b>Communication, Information Technology, Numerical</b>		
4.1	Work effectively both in a team, and independently on solving chemistry problems.	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Scientific discussion</li> <li>• Library visits</li> <li>• Web-based study</li> </ul>	<ul style="list-style-type: none"> <li>• web-based student performance systems</li> <li>• individual and group presentations</li> </ul>
4.2	Communicate effectively with his lecturer and colleagues		
<b>5.0</b>	<b>Psychomotor</b>		
5.1	NOT APPLICABLE		
5.2			

5. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Assignments	Weekly	10%
2	Mid-Term Exam	7	20%
3	Practical Exam	15	30%
4	Final Exam	16	40%

#### D. Student Academic Counseling and Support

1. 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)

- We have faculty members to provide counselling and academic advice.
- 2 hours per week as office hours are available for discussion with the students.

#### E. Learning Resources

1. List Required Textbooks

- \* 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, J. Laidler, 4<sup>th</sup> ed., John Wiley & Sons, 1994.

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)

- \* Physical Chemistry, Amazon logo *Silbey, R. R. Alberty, M. Bawendi, 4<sup>th</sup> ed., John Wiley & Sons, 2004.*
- \* Physical Chemistry, Peter Atkins & Julio de Paula, 10<sup>th</sup> ed., *W. H. Freeman and Company, 2014.*
- \* Catalytic Chemistry, Bruce C. Gates, New York, John Wiley & Sons, 1992.

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

- <http://en.wikipedia.org/wiki/>
- <http://www.chemweb.com/>
- Websites on the internet relevant to the topics of the course

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

#### F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

- \* Appropriate teaching class including white board and data show with at least 25 seats.
- \* Chemistry laboratories.

2. Computing resources (AV, data show, Smart Board, software, etc.)

- \* Computer Halls access for the students will be helpful in doing their tasks during the course.

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

- \* No other requirements.

## G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching <ul style="list-style-type: none"><li>• Student discussion with the instructor allow for continuous feed back through the course progress.</li><li>• Student Evaluation Questionnaires.</li></ul>	2
2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor <ul style="list-style-type: none"><li>• Discussions within the group of faculty teaching the course.</li><li>• Peer consultation on teaching strategies and its effectiveness.</li></ul>	0
3 Processes for Improvement of Teaching <ul style="list-style-type: none"><li>• Workshops given by experts on new teaching and learning methodologies will be attended.</li><li>• Improving of the teaching strategies by monitoring the evaluation of the students progress through the semester</li></ul>	1
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) * Not effective yet.	6
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. <ul style="list-style-type: none"><li>• The course will be evaluated periodically after each semester based on the results of the students and the report presented by the teaching staff that will be discussed with the course coordinator so as to improve the course.</li></ul>	

**Faculty or Teaching Staff: Dr. Tahani M. Bawazeer**

**Signature:**

**Date Report Completed: 2016**

**Received by: Dr Hatem M. Altass Department Head**

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_