



# Course Specifications

<b>Course Title:</b>	Kinetics and Reaction Mechanism
<b>Course Code:</b>	336CHEM-4
<b>Program:</b>	Bachelor of Science in Chemistry
<b>Department:</b>	Chemistry
<b>College:</b>	Science
<b>Institution:</b>	King Khalid University

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## A. Course Identification

<b>1. Credit hours:</b> 4 (2+2)
<b>2. Course type</b>
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"/>
<b>3. Level/year at which this course is offered:</b> Level 6/ Year 3
<b>4. Pre-requisites for this course (if any):</b> 232CHEM-2
<b>5. Co-requisites for this course (if any):</b> None

### 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2	50%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other (Laboratory)	2	50%

### 7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
<b>Contact Hours</b>		
1	Lecture	30
2	Laboratory/Studio	60
3	Tutorial	
4	Others (specify)	
	<b>Total</b>	90
<b>Other Learning Hours*</b>		
1	Study	30
2	Assignments	20
3	Library	
4	Projects/Research Essays/Theses	10
5	Others (specify)	
	<b>Total</b>	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 provides students with both experimental and theoretical knowledge of chemical reaction kinetics and mechanism. It aims at introducing students to the fundamental principles and concepts of the reaction rate, factors that affect the reaction rate, the reaction rate law, activation energy, differential and integrate rate laws for zero, first and second order reactions, and the Half-life of reactions. Kinetics and Mechanisms for basic and complex reactions are also discussed implementing the steady-state approximation and rate determining step.

### **2. Course Main Objective**

This course aims at introducing students to the fundamental knowledge and principles in the kinetics and reaction mechanisms including: concepts of the reaction rate, the rate law, the factors that affect reaction rates, differential and integrate rate laws for zero, first and second order reactions, half-life, activation energy, catalyst, and reaction mechanisms implicating molecularity, the steady-state approximation and rate determining step.

### 3. Course Learning Outcomes

CLOs		Aligned PLOs
1	<b>Knowledge:</b>	
1.1	To demonstrate knowledge of the fundamental concepts and principles of reactions rates.	K1
1.2	To understand the kinetic equations for determining the rate law parameters for different reaction orders.	K2
1.3	To outline reaction mechanisms for few basic reaction types.	K3
2	<b>Skills :</b>	
2.1	To illustrate the applications of kinetics chemistry.	S1
2.2	To apply the kinetics equations to distinguish reaction orders.	S2
2.3	To relate a reaction mechanism to the rate laws.	S3
3	<b>Competence:</b>	
3.1	To present an oral explanation for a subject in the area.	C1&C3&C4
3.2	To interact positively with colleagues in a group work.	C2&C3
3.3		

### C. Course Content

No	List of Topics	Contact Hours
1	Course Introduction Mathematical background review Linear regression Logarithms and exponentials Differentiation and integration	2
2	The Rates of Chemical Reactions Introduction Rates of chemical reactions Factors that affect reaction rates Rate law Reaction order Temperature dependence of rate Constants Catalyst	6
3	Midterm Exam 1 ( + Exam review)	2
4	Differential and Integrated Rate Laws Zero-order reaction First-order reaction Linear regression demonstration Second-order reaction $n^{\text{th}}$ order reaction Pseudo-first-order reactions Analysis of kinetic results	8
5	Midterm Exam 2 ( + Exam review)	2
6	Complex reactions	6

	Opposing reactions Parallel reactions Consecutive reactions	
7	Reaction mechanisms Rate determining Step Steady state approximation	4
	<b>Practical Work (List of Experiments)</b>	
1	Homogeneous Catalytic Decomposition of Hydrogen Peroxide by Potassium Dichromate.	4
2	Heterogeneous Catalytic Decomposition of Hydrogen Peroxide by (MnO <sub>2</sub> ).	4
3	Hydrolysis of Ethyl acetate in Acidic Medium.	4
4	Persulphate – Iodide Reaction as Second Order Reaction.	4
5	Effect of Temperature on Reaction Rate and Determination of Activation Energy for N <sub>2</sub> S <sub>2</sub> O <sub>8</sub> & KI Reaction.	4
6	Pseudo Unimolecular Reaction ( Persulphate-Iodide Reaction ).	4
7	Saponification of Ethylacetate.	4
8	Hydrolysis of Isobutylacetate (Zero Order Reaction).	4
9	Determination of Reaction Order and Rate Constant for Sulphit-Iodate Reaction " Clock Reaction".	4
10	Catalytic Salt Effect.	4
11	Effect of Solvent on Reaction Rate.	4
12	Catalytic Decomposition of Hydrogen Peroxide Followed by Gasometrically.	4
13	Study of Inversion of Sucrose to Glucose and Fructose Followed by Polarimeter.	4
14	Study of Alkaline Hydrolysis of Ethylacetate by Conductometer.	4
15	Final practical exam	4
<b>Total</b>		<b>90</b>

## D. Teaching and Assessment

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

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge</b>		
1.1	To demonstrate knowledge of the fundamental concepts and principles of reactions rates.	Lectures and Interactive teaching sessions	Written Exams, Electronic quizzes, and HomeWorks
1.2	To understand the kinetic equations for determining the rate law parameters for different reaction orders.	Lectures and Interactive teaching sessions	Written Exams, Electronic quizzes, and HomeWorks
1.3	To outline reaction mechanisms for few basic reaction types.	Lectures and Interactive teaching sessions	Written Exams, Electronic quizzes, and HomeWorks
<b>2.0</b>	<b>Skills</b>		
2.1	To illustrate the applications of	Lectures, problem	Written Exams,

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	kinetics chemistry.	solving examples,	Electronic quizzes, and HomeWorks
2.2	To apply the kinetics equations to distinguish reaction orders.	Lectures, Practical sessions, problem solving examples	Experimental reports and Written Exams, and HomeWorks
2.3	To relate a reaction mechanism to the rate laws.	Lectures, problem solving examples	Written Exams, Electronic quizzes, and HomeWorks
<b>3.0</b>	<b>Competence</b>		
3.1	To present an oral explanation for a subject in the area.	Interactive teaching sessions	Fast and short questions
3.2	To interact positively with colleagues in a group work.	Interactive teaching sessions	Laboratory reports

## 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	HomeWorks	5	2.5
2	Electronic Quizzes	2,4,6,8,10	2.5
3	Midterm Exam-1	6	10
4	Midterm Exam-2	11	10
5	Final Practical Exam	15	25
6	Final Written Exam	16	50

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

& separated from theory lecture with independent lecturer

## E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :  
Office hours: 10 hours per week

## F. Learning Resources and Facilities

### 1. Learning Resources

<b>Required Textbooks</b>	الكيمياء الحركية وميكانيكية التفاعلات الكيميائية – د. سليمان بن حماد الخويطر - دار الخريجي للنشر - 1998 - الطبعة الأولى (Chemical Kinetics and Reaction Mechanisms by Sulaiman H Alkuiter, 1998, 1 <sup>st</sup> ed. (Written in Arabic))
<b>Essential References Materials</b>	<ul style="list-style-type: none"> <li>Physical Chemistry by Peter Atkins and Julio de Paula, 2009, 9<sup>th</sup> ed.</li> <li>Principles of Chemical Kinetics by James E. House, 2007, 2<sup>nd</sup> ed.</li> <li>Chemical Kinetics and Reaction Dynamics by Paul L. Houston, 2006, 1<sup>st</sup> ed.</li> </ul>
<b>Electronic Materials</b>	E-Learning Deanship ( <a href="http://elc.kku.edu.sa/en/">http://elc.kku.edu.sa/en/</a> ).
<b>Other Learning Materials</b>	Excel software

## 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom and Laboratory
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	Data show, excel software and Internet access.
<b>Other Resources</b> (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	<ul style="list-style-type: none"> <li>• General Lab Equipment (Glassware, Digital balance, Water Bath, stopwatches....etc)</li> <li>• Conductometer</li> <li>• Polarimeter</li> </ul>

## G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course delivery (teaching methods and assessment methods)	Students	Questionnaire
	Departmental plan and curriculum committee; external reviewers	Reports and workshops
	Program leader	Meetings
Course contents (update)	Departmental plan and curriculum committee; external reviewers	Reports and workshops
Quality of learning resources	External reviewers	Reports

**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

<b>Council / Committee</b>	Department counsel
<b>Reference No.</b>	1/22/142
<b>Date</b>	15-9-1442