# Course Specifications

| | |
|---|---|
| **Course Title:** | Mechanism of Organic Reactions |
| **Course Code:** | 416CHEM-2 |
| **Program:** | Bachelor of Science in Chemistry |
| **Department:** | Chemistry |
| **College:** | Science |
| **Institution:** | King Khalid University |

# Table of Contents

## A. Course Identification

| |
|---|
| **1. Credit hours:** 2 |
| **2. Course type**<br>**a.** University ☐ College ☐ Department ■ Others ☐<br>**b.** Required ■ Elective ☐ |
| **3. Level/year at which this course is offered:** level 7/ Year 4 |
| **4. Pre-requisites for this course** (if any)**:** 313CHEM-2-S |
| **5. Co-requisites for this course** (if any)**:** No Co-requisite |

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

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | 2 | 100% |
| 2 | **Blended** | 0 | 0 |
| 3 | **E-learning** | 0 | 0% |
| 4 | **Correspondence** | 0 | 0 |
| 5 | **Other** | 0 | 0 |

**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** | 10 |
| 2 | **Assignments** | 10 |
| 3 | **Library** | 10 |
| 4 | **Projects/Research Essays/Theses** | -- |
| 5 | **Others** (specify) | --- |
| | **Total** | 30 |

* 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

The aim of this course is to provide basic knowledge and concept of organic reaction mechanisms, such as nucleophilic substitution reactions, $S_N^1$, $S_N^2$ and their reaction mechanisms, elimination reactions, E1, E2 and their reaction mechanisms, electrophilic addition reactions to C=C and their reaction mechanisms, nucleophilic addition reactions to C=O and their reaction mechanisms and Train the students, how to determine the type of the reaction and its mechanism discussed.

### 2. Course Main Objective

- To ensure the ability of the students to know the importance of the organic reaction mechanisms.
- To improve the skills to design for organic synthesis.
- To understand the order of reactions.
- To realize and know the transition in the reaction mechanisms
- To acquire the capability of determine the type of the reaction.

### 3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge:** | |
| 1.1 | To understand the basic concepts of organic reaction mechanisms. | **K1 and K.2** |
| 1.2 | To describe different types of organic reaction mechanisms including substitution reactions, elimination reactions and addition reactions. | **K1 and K2** |
| 1.3 | To recognize the basic and ethics scientific research in the field of the study. | **K2 and K3** |
| **2** | **Skills:** | |
| 2.1 | Recognize the basic concepts of organic reaction mechanisms, such as $S_N^1$, $S_N^2$, E1, E2, electrophilic and nucleophilic addition reactions. | **S1 and S2** |
| 2.2 | To improve the abilities to design for organic synthesis. | **S3 and S4** |
| **3** | **Competence:** | |
| 3.1 | To present an oral description of a subject in reaction mechanism. | **C1 and C2** |
| 3.2 | To cooperate confidently with colleagues in a teamwork. | **C2 and C3** |
| 3.3 | To contribute with colleagues to organize and deliver a presentation and report of group work | **C1 and C1** |
| 3.4 | To summarize the literature and sources for an area in the course. | **C1 and C2** |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Introduction to organic reaction mechanisms, Types of bond fission, Classification of organic réactions and classification of Reagents). | 2 |
| 2 | Methods of determination of reaction mechanism (Product studies (Analysis), detection and identification of intermediate). | 2 |
| 3 | Methods of determination of reaction mechanism (Kinetic evidence and Isotopic labeling). | 2 |

| | | |
|---|---|---|
| 4 | Methods of determination of reaction mechanism (Stereochemical studies and crossover experiments). | 2 |
| 5 | Nucleophilic substitution reactions: $S_N^1$, $S_N^2$ and internal nucleophilic substitution ($SN^i$) reactions. | 4 |
| 6 | Nucleophilic aromatic substitution reactions. | 2 |
| 7 | Elimination Reactions $E_1$ and $E_2$ | 4 |
| 8 | Electrophilic Addition to C=C: (addition of halogens, addition of HOX, Hydroxylation, addition of $H_2O$ and addition of $BH_3$. | 4 |
| 9 | Nucleophilic addition to carbonyl group: (addition of $H_2O$(Hydration), addition of alcohols, addition of HCN, addition of $HSO_3^-$, addition of amines, addition of hydrazine, addition of hydroxylamine). | 4 |
| 10 | Rearrangement Reactions | 4 |
| **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 | To understand the basic concepts of organic reaction mechanisms. | • Lectures<br>• Classroom discussion<br>• Case study | • Homework<br>• Assignments<br>• Examinations |
| 1.2 | To describe different types of organic reaction mechanisms including substitution reactions, elimination reactions and addition reactions. | | |
| 1.3 | To recognize the basic and ethics scientific research in the field of the study. | | |
| **2.0** | **Skills** | | |
| 2.1 | Recognize the basic concepts of organic reaction mechanisms, such as $S_N^1$, $S_N^2$, E1, E2, electrophilic and nucleophilic addition reactions. | • Lectures<br>• Classroom discussion<br>• Case study | • Written exams<br>Oral discussion |
| 2.2 | To improve the abilities to design for organic synthesis. | | |
| **3.0** | **Competence** | | |
| 3.1 | To present an oral description of a subject in reaction mechanism. | • Lectures<br>• Classroom discussion<br>• Case study | • Class activities<br>• Oral presentation for students reports<br>Oral discussion |
| 3.2 | To cooperate confidently with colleagues in a teamwork. | | |
| 3.3 | To contribute with colleagues to organize and deliver a presentation and report of group work | | |
| 3.4 | To summarize the literature and sources for an area in the course. | | |

### 2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 1 | 1st Mid-term | 5 | 15% |
| 2 | 2nd Mid-term | 10 | 15% |
| 3 | Review, Tutorials, Report, Discussions, Presentation and HomeWorks | 3, 7, 11, 14 | 20% |
| 4 | Practical Section | -- | ---- |
| 5 | Final written exam | 16 | 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:**
10 office hours are offered for students for individual consultations. Communications are available on-site, phone conversations, and chatting by social media.

## F. Learning Resources and Facilities

### 1.Learning Resources

| | |
|---|---|
| **Required Textbooks** | ➢ A guidebook to mechanism in organic chemistry: Peter Sykes, Longman, UK, 6th ed., 2010.<br>➢ Marchs Advanced Organic Chemistry: Reactions, Mechanisms And Structure, Michael B. Smith, Wiley, 7th Edition., 2013.<br>➢ Understanding Organic Reaction Mechanisms: Adam Jacobs, Cambridge University Press; UK, 2012. |
| **Essential References Materials** | March's Advanced Organic Chemistry, Reactions, Mechanisms and structures, Michael B. Smith and Jerry March, A John Wiley & Sons, Inc. Publication, 6th ed., 2007. |
| **Electronic Materials** | http://www.chemguide.co.uk/ |
| **Other Learning Materials** | ➢ Overhead projector with data show.<br>➢ CD & DVD.<br>➢ ISIS Draw<br>➢ Chem Draw |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | Lecturer room contain Data Show.<br>Blackboard |

| Item | Resources |
|---|---|
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | • Data Show.<br>• Smart board.<br>• Internet access.<br>• Accessible databases |
| **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 |
|---|---|---|
| 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

| | |
|---|---|
| **Council / Committee** | Department counsel |
| **Reference No.** | 1/22/142 |
| **Date** | 15-9-1442 |