هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

# Course Specification
## (Bachelor)

| | |
|---|---|
| **Course Title:** | **Bioorganic Chemistry** |
| **Course Code:** | **CHM 1424** |
| **Program:** | **Bachelor of Science in Chemistry** |
| **Department:** | **Chemistry** |
| **College:** | **Science** |
| **Institution:** | **Imam Mohammed Ibn Saud Islamic University** |
| **Version:** | 20224 v1 |
| **Last Revision Date:** | 14 October 2024 |

## Table of Contents

## A. General information about the course:

### -1. Course Identification

| | | | | | |
|---|---|---|---|---|---|
| **1. Credit hours: 2 (2 Lectures, 0 Tutorials, 0 Lab)** | | | | | |
| **2(2 Lectures, 0 Tutorials, 0 Lab)** | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☒ Department | ☐Track | ☐Others |
| **B.** | ☐ Required | | ☒ Elective | | |
| **3. Level/year at which this course is offered: Level 7/ Year 4** | | | | | |
| **4. Course general Description:** | | | | | |
| This course is designed to provide students with a basic understanding of the chemical nature of biomolecules and biomacromolecules. As part of this course, students will be introduced to Bioorganic Chemistry of Amino Acids and Polypeptides discussing Organic Reactions and Biochemical Transformations. The course will extend to cover Enzyme Chemistry as a biocatalysts including Multifunctional Catalysis and Simple Models. Throughout the course , practical examples and visual aids will be employed in order to emphasize the significance and ramifications of the subject matter. | | | | | |
| **5. Pre-requirements for this course** (if any): | | | | | |
| **CHM1321 Heterocyclic Chemistry** | | | | | |
| **6. Co-requisites for this course** (if any): | | | | | |
| **None** | | | | | |
| **7. Course Main Objective(s):** | | | | | |

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

- **Identify, classify and name of biochemical compounds in the living systems.**
- **Apply knowledge of amino acids and peptides, their biochemical and physical properties, as catalysts in biochemical processes.**
- **Recognize the link between synthetic organic chemistry and enzyme catalyzed reactions**
- **Use the vocabulary on organic chemicals and reactions in metabolism and other biochemical applications**
- **Be familiar with chemical reaction mechanisms of enzyme-catalyzed reactions**

### 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | **30** | **100%** |
| 2 | E-learning | **0** | **0** |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | **0** | **0** |

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 4 | Distance learning | 0 | 0 |

### 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | **Lectures** | 30 |
| 2. | **Laboratory/Studio** | 0 |
| 3. | **Field** | 0 |
| 4. | **Tutorial** | 0 |
| 5. | **Others (specify)** | 0 |
| **Total** | | 30 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of PLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| **1.1** | To recall Chemistry of Amino Acids and Polypeptides and its role in living systems. catalytic effect of enzymes in organic media | K1; K3 | ▪ Two hours are weekly containing lectures, and Oral Discussion.<br>▪ A Private study including home exam. | ▪ Quizzes Assignments<br>▪ Oral Discussion<br>▪ Participation. |
| **1.2** | To outline the chemical reaction mechanism during enzymatic and co-enzymatic process as a catalyst | K1; K3 | Two hours are weekly containing lectures and group discussion | ▪ Quizzes<br>▪ Assignments.<br>▪ Oral Discussion marks |
| **1.3** | To describe the role of enzymes in Metal Ions in Proteins and Biological Molecules | K3 | ▪ Two are weekly for Lectures activities<br>▪ Think and talk about Bioorganic Chemistry | ▪ Quizzes<br>▪ Home exam<br>▪ Oral Discussions. |
| **2.0** | **Skills** | | | |

| Code | Course Learning Outcomes | Code of PLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 2.1 | **To explain the role and synthesis of Amino Acids and Polypeptides in living systems** | **K1; K3** | • Lectures activity Think and talk about the Biosynthesis of Bioorganic Molecules. | ▪ Questions in Lectures.<br>▪ Short Quizzes and Exams.<br>▪ Participation<br>▪ Oral Discussion,<br>▪ Home Exam. |
| 2.2 | **To evaluate the chemical process during the catalytic period of enzymes and co-enzyme as Multifunctional Catalysis and Simple Models** | **S1; S2; S3** | Introduce some examples on the bioactivity properties of some Biomolecules. | • Questions in Lectures.<br>• Short Quizzes and Exams. |
| 2.3 | **To summarize different situations and problems in isolation of specific natural products group** | **S1; S3** | • Lectures, and Group discussion<br>• Brainstorming Exercises | ▪ Questions in Lectures.<br>▪ Short Quizzes and Exams. |
| 2.4 | **To justify the molecular Devices in its sounding applications** | **S1; S3; S4** | • Encourage the students to outline the molecular devices applications | ▪ Assignments |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| **3.1** | **To show intellectual and scientific integrity during assignments, projects, and reports** | **V1; V2** | • Group Discussion and Assignments.<br>• | ▪ Oral Tests<br>▪ Assignments Marks |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to Bioorganic Chemistry:** Basic Considerations, Proximity Effects in Organie Chemistry, Molecular Adaptation Molecular Recognition and the Supramolecular Level. | 3 |
| 2 | **Bioorganic Chemistry of Amino Acids and Polypeptides**: Chemistry of the Living Cells, Analogy Between Organie Reactions and Biochemical Transformations, Chemistry of the Peptide Bond, Nonribosomal Peptide Bond Formation, Asymmetrie Synthesis of a-Amino Acids, Asymmetrie Synthesis | 4 |

| | | |
|---|---|---|
| | with Chiral Organometallic Catalysts, Antibodies as Enzymes, Chemieal Mutations, Molecular Recognition and Drug Design. | |
| 3 | **Enzyme Chemistry:** Introduction to Catalysis, Introduction to Enzymes, Multifunctional Catalysis and Simple Models, a-Chymotrypsin, Other Hydrolytic Enzymes, Stereo electronic Control in Hydrolytic Reactions, Immobilized Enzymes and Enzyme Technology, Enzymes in Synthetic Organic Chemistry, Enzyme-Analog-Built Polymers, Design of Molecular Clefts | 6 |
| 4 | **Enzyme Models:** Host-Guest Complexation Chemistry, New Developments in Crown Ether Chemistry, Membrane Chemistry and Micelles, Polymers 5.5 Cyclodextrins, Enzyme Design Using Steroid Template, Remote Functionalization Reactions, Biomimetic Polyene Cyclization's | 5 |
| 5 | **Metal lons:** Metal Ions in Proteins and Biological Molecules, Carboxypeptidase A and the Role of Zinc, Hydrolysis of Amino Acid Esters and Amides and Peptides, Iron and Oxygen Transport | 5 |
| 6 | **Coenzyme Chemistry:** Oxidoreduction, Pyridoxal Phosphate, Suicide Enzyme Inactivators and Affinity Labels, Thiamine Pyrophosphate Biotin. | 4 |
| 7 | **Molecular Devices:** Introduction to Self-Organization and Self-Assembly 8.2 General Overview of the Approach, Specific Examples | 3 |
| **Total** | | 30 |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Quizzes, Attendance, Participation, Home Exams | All the semester | 20 % |
| 2. | Midterm Exam 1 | Around 6th & 7th week | 20 % |
| 3. | Midterm Exam 2 | Around 11th & 12th week | 20 % |
| 4. | Final Exam | Around 16-17th week | 40 % |
| 5. | Total | | 100% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

| | |
|---|---|
| Essential References | **Bioorganic Chemistry: A Chemical Approach to Enzyme Action**, Hermann Dugas Christopher Penney, Springer , 1996, US, ISBN-13 : 978-1468400977 |

| | |
|---|---|
| | **Bio-organic Chemistry**, Harish K. Chopra, Anupama Parmar, Parmjit S. Panesar, Alpha Science, 2012, ISBN: 9781842657737 |
| **Supportive References** | **Organic Chemistry of Enzyme-Catalyzed Reactions,** Richard B. Silverman, 2nd Edition, Academic Press, 2002. ISBN : 9780126437317 |
| **Electronic Materials** | **Blackboard** |
| **Other Learning Materials** | • Bioorganic & Medicinal Chemistry Letters<br>• Bioorganic & Medicinal Chemistry<br>• Tetrahedron asymmetry<br>• Bioorganic Chemistry.<br>• Saudi Digital Library |

## 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Each classroom is equipped with PC and retro projector with a maximum of 25 students. |
| **Technology equipment**<br>(projector, smart board, software) | The rooms are equipped with data show, Smart Board, WI-FI access. |
| **Other equipment**<br>(depending on the nature of the specialty) | None |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students | **Direct:** Questionnaire. |
| | Course Responsible | **Direct:** Course e-Portfolio.<br>**Indirect:** Second examiner checklist-Course report. |
| | Peer Reviewer | **Direct:** Questionnaire.<br>**Indirect:** External assessor report. |
| Effectiveness of Students' assessment | Program Leaders | **Direct:** Course e-Portfolio.<br>**Indirect:** Course report. |
| | Students | **Indirect:** Second examiner checklist-Course report. |
| Quality of learning resources | Faculty ( Academic Advisory) | **Direct:** course Entrance/Exit.<br>**Indirect:** Observations - Accreditation review. |

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| | Program Leaders | **Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review. |
| The extent to which CLOs have been achieved | Course Responsible | **Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report. |
| | Program Leaders | **Indirect:** Exams. |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

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|---|---|
| **COUNCIL /COMMITTEE** | **COUNCIL OF DEPARTMENT OF CHEMISTRY** |
| **REFERENCE NO.** | **7 (NO. 2/3)** |
| **DATE** | **29/3/1446 - 2/10/2024** |