Course Specification
(Bachelor)

Course Title:	Bioorganic Chemistry
Course Code:	CHM 1372
Program:	Bachelor of Science in Chemical Laboratories
Department:	Chemistry
College:	Science
Institution:	Imam Mohammad ibn Saud Islamic University
Version:	2024-1
Last Revision Date:	15 September 2024

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A. General information about the course:

1. Course Identification

1. Credit hours: (3) 3 (3 Lectures, 0 Lab, 0 Tutorials)					
3 (3 Lectures, 0 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☐Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Level 6 /year 3)					
4. Course General Description:					
This course is designed to give students a basic understanding of the chemical nature of biomolecules and biomacromolecules. As part of this course, students will be introduced to the bioorganic chemistry of amino acids and polypeptides, which will discuss organic reactions and biochemical transformations. The course will extend to cover enzyme chemistry as a biocatalyst, 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)**:**					
Introduction in Biochemistry, CHM 1371					
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 biochemical compounds in the living systems.**
- ✓ **Apply the knowledge of amino acids, peptides, and their biochemical and physical properties as catalysts in the biochemical process.**
- ✓ **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	**45**	**100 %**
2	E-learning	**0**	**0**
3	Hybrid • Traditional classroom • 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**	45
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		45

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall the chemistry of amino acids and polypeptides and their role in living systems. Catalytic effect of enzymes in organic media**	**K1, K3**	• Three hours are weekly, containing lectures. • A Private study, including work on the home exam.	**Direct:** ✓ Quizzes, exams ✓ Assignments ✓ Discussions. ✓ Participation
1.2	**To Outline the chemical reaction mechanism during the enzymatic and co-enzymatic process as a catalyst**	**K1, K4**	• Three hours are weekly • group discussions. • A Private study, including work on homework.	**Direct:** ✓ Quizzes ✓ Assignments. ✓Oral Discussion
1.3	**To Describe the role of enzymes in Metal Ions in Proteins and Biological Molecules.**	**K1, K4**	• Group discussions. • A Private study, including work on homework. • Think and talk about Think and talk about Bioorganic Chemistry and	**Direct:** ✓Midterms. ✓Assignments ✓Oral Discussions. ✓Quizzes.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			chemical applications	
2.0	**Skills**			
2.1	**To explain the role and synthesis of Amino Acids and Polypeptides in living systems**	**S3, S4**	• Lectures activity • Think and talk about Biosynthesis of Bioorganic Molecules.	**Direct:** ✓Questions in Lecture ✓Short Quizzes and Exams. ✓Participation ✓Oral Discussion, Home Exam.
2.2	**To evaluate the chemical process during the catalytic period of enzymes and co-enzymes as Multifunctional Catalysis and Simple Models**	**S3,S4**	Introduce some examples of the bioactivity properties of some Biomolecules	**Direct:** ✓Questions in Lectures ✓Participation ✓Oral Discussion Short Quizzes and Exams.
2.3	**To summarize different situations and problems in isolation of specific natural product group**	**S1, S3**	• Lectures, • Group discussion • Brainstorming Exercises	**Direct:** ✓Questions in Lecture ✓Short Quizzes and Exams.
2.4	**To justify the molecular Devices in their sounding applications**	**S2, S3**	• Brain Storms Exercises • Encourage the students to outline the molecular device applications	**Direct:** ✓Oral Discussion. ✓Group Discussion ✓Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	**To appraise teamwork and create awareness to maintain scientific integrity during different assessments, projects, and mini-projects.**	**V2**	**Group discussion, assignments, and homework**	**Direct** ✓**Oral tests,** ✓**Assignments and homework marks** ✓**Mini projects**
3.2	**Develop personal values and attributes such as**	**V1, V2**	**Teamwork and class discussions**	**Direct** **Mini projects**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	honesty, empathy and respect for others			

C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction to Bioorganic Chemistry:** Basic Considerations, Proximity Effects in Organic Chemistry, Molecular Adaptation Molecular Recognition and the Supramolecular Level.	6
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, Asymmetric Synthesis of a-Amino Acids, Asymmetric Synthesis with Chiral Organometallic Catalysts, Antibodies as Enzymes, Chemical Mutations, Molecular Recognition, and Drug Design.	6
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	6
5	**Metal ions:** 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	12
6	**Coenzyme Chemistry:** Oxidoreduction, Pyridoxal Phosphate, Suicide Enzyme Inactivators and Affinity Labels, Thiamine Pyrophosphate Biotin.	6
7	**Molecular Devices:** Introduction to Self-Organization and Self-Assembly 8.2 General Overview of the Approach, Specific Examples	3
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	Week 6th - 7th	20 %
2.	Midterm 2	Week 11th -12th	20 %
3.	Quizzes, homework, class participation	During semester	20 %
.4	Final examination	Week 16th	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	Hermann Dugas Christopher Penney, **Bioorganic Chemistry: A Chemical Approach to Enzyme Action**, Springer , 1996, US, ISBN-13 : 978-1468400977 Harish K. Chopra, Anupama Parmar, Parmjit S. Panesar, **Bio-organic Chemistry**, Alpha Science, 2012, ISBN: 9781842657737
Supportive References	Richard B. Silverman, **Organic Chemistry of Enzyme-Catalyzed Reactions**, 2nd Edition, Academic Press, 2002. ISBN: 9780126437317
Electronic Materials	• Blackboard
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Each classroom should have a whiteboard and a projector, with a maximum of 20 students.
Technology equipment (projector, smart board, software)	The rooms have data show, Smart Board, and WI-FI access.
Other equipment (depending on the nature of the specialty)	

F. . Assessment of Course Quality

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

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	COUNCIL OF DEPARTMENT OF CHEMISTRY
REFERENCE NO.	3 (NO. 1/3)
DATE	5/3/1446- 8/09/2024