Course Specification

(Postgraduate Programs)

Course Title:	**Advanced Bio-Organic Chemistry**
Course Code:	**CHM 6125**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3 (3 Lectures, 0 Lab, 0 Tutorials)					
2. Course type					
A.	☐University	☐College	☐Department	☐Track	
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Level 2/Year 1)					
4. Course General Description:					
This course covers topics related to the essential role of enzymes such as biological importance, reaction mechanisms, and their application in drug design and development.					
5. Pre-requirements for this course (if any)**:**					
CHM 6121					
6. Co-requirements for this course (if any)**:**					
7. Course Main Objective(s):					
• **Recognize the general principles and strategies involved in discovering and designing new drugs and how to develop them.** • **Understand the structure and function of important drug targets and how drugs interact with their molecular targets and the consequences of those interactions.** • **Explain the structure and biological activity of different Enzymes.** • **Describe the basic properties of enzymes and their mechanisms of action.** **Understand the structure and biological function of Coenzymes.**					

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid		

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning		

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

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)……**	
	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 Drug discovery and Dug Design development**	**K1. *Org*.; K2. *Org*.; K3. *Org*.**	▪ **Five hours/week lectures.** ▪ **Self-study.** **Home-exam**	▪ **Regular Exams.** ▪ **Assignments.** ▪ **Short Quizzes.** ▪ **Oral Discussion.** **Participation.**
1.2	**To outline the Chemical Reaction Mechanism during enzymatic process as a catalyst**	**K1. *Org*.; K2. *Org*.; K3. *Org*.**	▪ **Five hours/week lectures.** ▪ **Think, and justify the chemical enzymatic**	▪ **Oral Discussion marks** ▪ **Literatures Survey** ▪ **Mini-seminar.**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			reaction mechanism, using available references (SDL) online. Open discussion.	▪ Participation.
1.3	To describe the role of enzymes in Organic Synthesis as Bio-catalysis.	K2. *Org.*; K4. *Org.*	▪ Five hours/week lectures. ▪ Group Discussion on bio-catalysis using available references (SDL) Open Discussion.	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
1.4	To state the Reaction Catalyzed by enzymes types	K3. *Org.*; K4. *Org.*	▪ Five hours/week lectures. Group Discussion using available references (SDL)	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
2.0	**Skills**			
2.1	To explain the role of enzymes as a Catalyst in Chemical Reaction.	S1. *Org.*; S2. *Org.*	▪ Lectures activity. ▪ Self-study Deep discussion on strategies for using enzymes as a catalyst in chemical reaction.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
				▪ Participation. Mini -seminar.
2.2	To justify Prodrug and Drug Delivery Systems in actions.	S1. *Org*.; S4. *Org*.	▪ Introduce some Prodrug and drug delivery examples and its action mechanism .for discussions. ▪ Self-study ▪ Brainstorming.	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	To outline the advantage of Bio-catalysis in Organic Synthesis.	S1. *Org*.; S3. *Org*. S4. *Org*.	▪ Lectures ▪ Oral Discussions. ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.
2.4	To demonstrate Oral Communication to the role of Enzymes in Organic Synthesis, Reaction Mechanisms and its applications, accompanying writing of mini-Reports, operating electronic mail, and Network in communicating with others.	S1. *Org*.; S4. *Org*.	▪ Group Discussion and Assignments ▪ Introduce several examples for catalyzed reaction by enzymes and co-enzymes, which will require reading, writing, and oral presentation.	▪ Oral Discussion. ▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			Encourage students to use electronic mail to submit Home Exams and Assignments.	
3.0	**Values, autonomy, and responsibility**			
3.1	To perform a scientific presentation, research, and work independently and integrate with a collaborated group, Using IT to acquire, analyze, and communicate information.	V1. *Org*.	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. Team work.	▪ Oral Discussion. ▪ Group Discussion. ▪ Assignments.
3.2	To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.	V1. *Org*.; V2. *Org*.	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects	▪ Participation ▪ Homework's Mini-project(s).
…				

C. Course Content:

No	List of Topics	Contact Hours
1.	*Drug discovery:*-Drug discovery without a lead; penicillins, Librium, Lead discovery; Random Screening, Focused Screening, Drug metabolism studies. Drug receptor interactions.	6
2.	*Dug design and development:* Strategies in drug design, Identification of the pharmacophore, Functional group modification, structural-	6

	activity relationships, Structure modification to increase potency and the therapeutic index, Structure modification to increase oral Bioavailability.	
3.	*Prodrug and drug delivery systems:*-Utility of prodrug; Absorption and Distribution, Site specificity, Toxicity, Types of prodrugs, Mechanism of Drug Activation; Carrier-Linkage for various functional groups; Alcohols, Carboxylic acids, Amines, sulfonamides, Carbonyl compounds.	7
4.	*Enzymes as catalysts:*-What are enzymes? How do enzymes work?, Specificity of Enzyme-catalyzed Reactions; Binding specificity, Reaction specificity, Rate acceleration	10
5.	*Mechanisms of Enzyme catalysis*:-Approximation, Covalent Catalysis, Acid-Base catalysis, Desolvation, Strain and distortion, Example of some typical enzyme mechanisms.	8
6.	*Kind of reaction catalyzed by enzymes:*-Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling af ATP cleavage to endergonic processes. Transfer of sulphate addition and elimination reactions, enolic intermediates in isomerization reactions, β –cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation reactions.	8
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)	weekly	
2.	Midterm Exam (1)	6th/7th week	
3.	Midterm Exam (2)	Around 11th– 12th week	
4.	Final Exam	17th week	
5.	Total		

*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	• ***An introduction to Medicinal Chemistry,*** **Graham L. Patrick, 5th Edition, Oxford University Press, 2013. ISBN 978-0-19-969739-7** • ***The organic chemistry of drug design and drug Action, Richard B. Silverman, 2nd Edition, Academic Press, 2004. ISBN : 0-12-643732-7*** • ***Organic Chemistry of Enzyme-Catalyzed Reactions, Richard B. Silverman, 2nd Edition, Academic Press, 2002. ISBN : 9780126437317***
Supportive References	***Bioorganic Chemistry: Highlights and New Aspects*****, U. Diederichsen, T. K. Lindhorst, B. Westermann , L. A. Wessjohann, Wiley-VCH, (1999), ISBN: 978-3-527-29665-1.**
Electronic Materials	• **Bioorganic & Medicinal Chemistry Letters** • **Bioorganic & Medicinal Chemistry** • **Tetrahedron** • **Tetrahedron Letters** • **Tetrahedron asymmetry** • **Bioorganic Chemistry.** • **Saudi Digital Library**
Other Learning Materials	• **Blackboard** • **Multimedia associated with the text book and the relevant websites.**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology equipment (Projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (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. Indirect: Second examiner checklist-Course report.
	Peer Reviewer	Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of students' assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review.
	Program Leaders	Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Course Responsible	
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.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	COUNCIL OF CHEMISTRY DEPARTMENT

REFERENCE NO.	**10 (NO. 2/10)**
DATE	**21/04/1444- 15/11/2022**