



## Lahore University of Management Sciences

### CHEM532 – Chemistry of Biomolecules

Fall 2023-24

To understand how to navigate course outlines, consult: How to Use a Course Outline (<http://surl.li/gpvuw> )

Instructor	Dr Muhammad Saeed
Room No.	9-413
Office Hours	TBD
Email	<a href="mailto:Muhammad.saeed@lums.edu.pk">Muhammad.saeed@lums.edu.pk</a>
Telephone	
Secretary/TA	TBD
TA Office Hours	TBD
Course URL (if any)	
Support Services	LUMS offers a range of academic and other services to support students. These are mentioned below, and you are encouraged to use these in addition to in-class assistance from course staff. For a complete list of campus support services available for you <a href="https://advising.lums.edu.pk/#supportservices">click here</a> ( <a href="https://advising.lums.edu.pk/#supportservices">https://advising.lums.edu.pk/#supportservices</a> )

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75 min
Recitation (per week)	Nbr of Lec(s) Per Week	As needed	Duration	60-120 min
Tutorial (per week)	Nbr of Lec(s) Per Week		Duration	

Course Distribution	
Core	
Elective	Chemistry
Open for Student Category	SSE students
Close for Student Category	NA

COURSE DESCRIPTION
Life at the molecular level is quite fascinating science and constitutes a balanced interplay between millions for molecules that can be categorized into simpler functional classes of biomolecules with similar chemistry. These biomolecules are involved in the maintenance and regulation of metabolic processes. Although these biomolecules are major part of a conventional biochemistry course; however, the <i>Chemistry of Biomolecules</i> deals mostly with the structural, reactional, and mechanistic aspect of biomolecules and their interplay to elicit biological, physiological or pathological response at the level of atoms and bonds. The study of biomolecules in this context have become crucial to tackle the modern challenges of biological sciences such as medicine, pharmacology and even biochemistry itself. Additionally, since majority of biomolecules are organic molecules, the <i>Chemistry of Biomolecules</i> can also motivate an organic chemist to mimic the chemistry of nature to design bioinspired-materials, -catalysts and -reactions. <i>Chemistry of Biomolecules</i> is thus a course for future leaders of biological sciences as well as of organic chemistry. In this course, fundamental concepts of organic chemistry will be utilized to explain how enzymes catalyze reactions of metabolic pathways and why metabolites react the way they do. Thus, <i>Chemistry of Biomolecules</i> aims not only to expand the conventional chemical research on structure, synthesis, and kinetics in a biological direction, but also prepare senior undergraduates and graduate students of chemistry and biology for the challenging area of drug-design, -discovery, and -delivery.

COURSE PREREQUISITE(S)	
<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>	For BS chemistry majors: Chem 332 For SSE: Bio212 and Chem231 For MS: at least two semesters of organic chemistry or biochemistry



## Lahore University of Management Sciences

### COURSE OBJECTIVES

- To develop fundamental understanding of the chemistry underlying biological processes
- To provide opportunity to chemistry majors to extend their capabilities towards biological and medicinal sciences
- To enable biology/science majors for applying tools of organic chemistry in solving problems of biology and medicine
- To enable students to convey biochemical information in a formal and scientific way

### Learning Outcomes

CLO-1	Upon successful completion of this course, the students will be able to: <ul style="list-style-type: none"><li>- Characterize and structurally analyze major biomolecules such as lipids, carbohydrates, amino acids, nucleic acids, vitamins, cofactors, several other small organic biomolecules</li><li>- Analyze biochemical reactions by applying the concepts of electrophilic, nucleophilic, acid-base reactions, redox reactions</li><li>- Apply the concepts of molecular interaction to explain the mechanisms of molecular recognition, self-assembly, and activity of biochemical reactions</li><li>- Explain the major classes of natural products and evaluate the biochemical pathway underlying their biosynthesis</li></ul>
CLO-2	
CLO-3	
CLO-4	

### Grading Breakup and Policy

Class Participation:	5% (Attendance, participation in group discussion, answering questions, asking questions etc)
Assignment(s):	10 % (3-4 small assignment/homework; the students will complete it in small groups or individually)
Quiz(s):	20 % (5-6 quizzes, 20 min each: in-class)
Midterm Examination:	30 % (One mid-term approximately in the mid of semester; in-class)
Final Examination:	35 % (Comprehensive)

### Examination Detail

Midterm Exam	Yes/No: <b>Yes</b> Combine Separate: <b>Combine</b> Duration: <b>to be announced later</b> Preferred Date: <b>During the university Mid-term Exam week</b> Exam Specifications: <b>Closed book; Course material in any form is not permitted</b>
Final Exam	Yes/No: <b>Yes</b> Combine Separate: <b>Combine</b> Duration: <b>to be announced later</b> Exam Specifications: <b>Closed book; Course material in any form in not permitted</b>

### Campus supports & Key university policies

#### Campus Supports

Students are strongly encouraged to meet course instructors and TA's during office hours for assistance in course-content, understand the course's expectations from enrolled students, etc. Beyond the course, students are also encouraged to use a variety of other resources. (Instructors are also encouraged to refer students to these resources when needed.) These resources include Counseling and Psychological Services/CAPS (for mental health), LUMS Medical Center/LMC (for physical health), Office of Accessibility & Inclusion/ OAI (for long-term disabilities), advising staff dedicated to supporting and guiding students in each school, online resources (<https://advising.lums.edu.pk/advising-resources>), etc. To view all support services, their specific role as well as contact information click here (<https://advising.lums.edu.pk/#supportservices>).



## Lahore University of Management Sciences

### Academic Honesty/Plagiarism

LUMS has zero tolerance for academic dishonesty. Students are responsible for upholding academic integrity. If unsure, refer to the student handbook and consult with instructors/teaching assistants. To check for plagiarism before essay submission, use [similarity@lums.edu.pk](mailto:similarity@lums.edu.pk). Consult the following resources: 1) Academic and Intellectual Integrity (<http://surl.li/gpvwb>), and 2) Understanding and Avoiding Plagiarism (<http://surl.li/gpvwo>).

### LUMS Academic Accommodations/ Petitions policy

Long-term medical conditions are accommodated through the Office of Accessibility & Inclusion (OAI). Short-term emergencies that impact studies are either handled by the course instructor or Student Support Services (SSS). For more information, please see Missed Instrument or 'Petition' FAQs for students and faculty (<https://rb.gy/8sj1h>)

### LUMS Sexual Harassment Policy

LUMS and this class are a harassment-free zone. No behavior that makes someone uncomfortable or negatively impacts the class or individual's potential will be tolerated.

To report sexual harassment experienced or observed in class, please contact me. For further support or to file a complaint, contact OAI at [oai@lums.edu.pk](mailto:oai@lums.edu.pk) or [harassment@lums.edu.pk](mailto:harassment@lums.edu.pk). You may choose to file an informal or formal complaint to put an end to the offending behavior. You can also call their Anti-Harassment helpline at 042-35608877 for advice or concerns. *For more information: Harassment, Bullying & Other Interpersonal Misconduct: Presentation* (<http://surl.li/gpvwt>)

### COURSE OVERVIEW

Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
<b>Module 1</b> Lecture 1-6	<b>Structural and stereochemical basis of biomolecules</b>	Lectures and recommended text	To enable students to apply basic concepts of functional groups, stereochemistry, and chemical bonding in describing different classes of biological molecules such as proteins, carbohydrates, lipid, and nucleic acids. (CLO = 1)
<b>Module 2</b> lecture 7-14	<b>Biochemical reactivity:</b> types of reactions and underlying mechanisms exhibited by biomolecules in cellular context	Lectures and recommended text	To enable students to apply the concepts of nucleophilicity, electrophilicity, acidity, basicity, and types of chemical reactions (addition, elimination, substitutions, oxidation, reduction, and rearrangements) in different biochemical pathways. (CLO = 2)
<b>Midterm</b>			
<b>Module 3</b> lecture 15-21	<b>Biomolecular interactions:</b> molecular recognition, assembly, and activity	Lecture notes and recommended text	To enable the students to analyze and apply the principles of intermolecular interactions (Hydrogen bonding, dipole-dipole interactions, van der Waals interactions and ionic interactions) to biomolecular interactions (CLO = 3)
<b>Module 4</b> lecture 22-28	<b>Medicinally important Natural products:</b> Alkaloids, terpenoids, carotenoids and other secondary metabolites	Lecture notes and recommended text	To enable the students to analyze and evaluate plant-based secondary metabolites and chemical principles behind the biosynthetic pathways leading to their synthesis (CLO=4)
<b>Final Exam</b>			

### Textbook(s)/Supplementary Readings

#### Recommended Textbooks:

**Biotransformations in Organic Chemistry** by Kurt Faber, 7<sup>th</sup> edition; Springer 2018

**The Molecules of Life: Physical and Chemical Principles** by John Kuriyan, Boyana Konforti and David Wemmer, Garland Science 2013.

**Organic Chemistry with Biological Applications** by John McMurry, 2<sup>nd</sup> Edition; Brooks/Cole Cengage Learning 2011

**Organic Chemistry** by Clayden, 2<sup>nd</sup> Edition; Oxford University Press, 2012



## **Lahore University of Management Sciences**

**Lehninger Principles of Biochemistry** by David L Nelson and Michael M. Cox, 6<sup>th</sup> edition, W. H. Freeman and Company 2013

**Fundamentals of Biochemistry-Life at the Molecular level** by Voet, Voet & Pratt, 4<sup>th</sup> Edition, John Wiley & Sons, Inc 2013

**Recent Literature:** Latest articles published in International Journals