Lahore University of Management Sciences
Biochemistry - BIO212/Chem251
Spring 2024

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Course URL	

COURSE TEACHING METHODOLOGY (Please mention following details in plain text)

Teaching Methodology: 100% synchronous
Lecture details: 100% live interactive lectures

COURSE BASICS				
Credit Hours	3			
Lecture(s)	Number per week	2	Duration	75 minutes each
Recitation (per week)	Number per week	1	Duration	45 minutes
Lab (if any) per week	Number per week	0	Duration	
Tutorial (per week)	Number per week		Duration	

COURSE DISTRIBUTION	
Core	Core
Elective	
Open for Student Category	Open for all undergraduates who meet prerequisites
Closed for Student Category	

COURSE DESCRIPTION

BIO212 is a sophomore-level undergraduate course designed to impart foundational knowledge and understanding of biochemical processes that permit organisms to live, divide as well as sense and adapt to different environmental conditions. Topics to be covered include structure-function relationship of various cellular components (i.e., nucleic acids, proteins, enzymes, carbohydrates, lipids, etc), bioenergetics, metabolism and its regulation, signaling, and membrane transport.

COURSE PREREQUISITE(S)	
	Biology 101; Chemistry 101

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COURSE OBJECTIVES

BIO212 aims to cover the various biochemical processes that organisms employ in order to live, propagate, and (by sensing, responding and adapting to their environment) evolve.

LEARNING OUTCOMES

At the end of this course, students should be well versed with:

- Types and strengths of chemical bonds, physical properties of water, and buffers.
- Structure and function of various cell components including nucleic acids, proteins, enzymes, lipids, and carbohydrates
- Various biochemical pathways through which energy is extracted and subsequently utilized
- How cells transport molecules across membrane
- Cell signaling pathways that allow cells to communicate (i.e., sense and respond) with their environment.
- Various methodologies through which structure of molecules is deciphered, and reactions monitored.
- How molecules interact with each other and how enzymes work.

GRADING BREAK UP: COMPONENT DETAILS AND WEIGHTAGES

Quiz(s): 20% (N-1 policy)
Midterm Examination: 40%
Final Examination: 40%

EXAMINATIONS

Midterm Exam	Yes/No: yes Combine/Separate: separate Duration: 90 min Preferred Date: Exam Specifications: multiple choice questions; short answer questions
Final Exam	Yes/No: Yes Combine/Separate: separate Duration: 90 minutes Exam Specifications: multiple choice questions; short answer questions

HARASSMENT POLICY

SSE, LUMS and particularly this class, is a harassment free zone. There is absolutely zero tolerance for any behavior that is intended, or has the expected result of making anyone uncomfortable and negatively impacts the class environment, or any individual's ability to work to the best of their potential. In case a differently-abled student requires accommodations for fully participating in the course, students are advised to contact the instructor so that they can be facilitated accordingly. If you think that you may be a victim of harassment, or if you have observed any harassment occurring in the purview of this class, please reach out and speak to me. If you are a victim, I strongly encourage you to reach out to the Office of Accessibility and Inclusion at oai@lums.edu.pk or the sexual harassment inquiry committee at harassment@lums.edu.pk for any queries, clarifications, or advice. You may choose to file an informal or a formal complaint to put an end of offending behavior. You can find more details regarding the LUMS sexual harassment policy here. To file a complaint, please write to harassment@lums.edu.pk.

SSE COUNCIL ON EQUITY AND BELONGING

In addition to LUMS resources, SSE's **Council on Belonging and Equity** is committed to devising ways to provide a safe, inclusive and respectful learning environment for students, faculty and staff. To seek counsel related to any issues, please feel free to approach either a member of the council or email at cbe.sse@lums.edu.pk

RIGHTS AND CODE OF CONDUCT FOR ONLINE TEACHING

A misuse of online modes of communication is unacceptable. TAs and Faculty will seek consent before the recording of live online lectures or tutorials. Please ensure if you do not wish to be recorded during a session to inform the faculty member. Please also ensure that you prioritize formal means of communication (email, lms) over informal means to communicate with course staff.

ACADEMIC HONESTY

A student-teacher relationship is purely based on honesty, integrity and inspiration. Where teacher's role is to make every effort possible to inspire his students about the subject and develop independent thinking and a problem-solving attitude about every concept, students are required to uphold values of truth and honesty and eagerness to learn. In this whole learning process honesty, integrity and commitment by students play a major role in their long-term success. It means a student performs all academic work, assignments, exams, quizzes and never gets involved in any unfair activity falling under academic dishonesty like cheating, unauthorized aid of any kind, plagiarism etc. Students are expected to demonstrate extremely high level of integrity and honesty throughout this course. Any instances of academic dishonesty in this course (intentional or unintentional) will be dealt with swiftly and severely. Potential penalties include receiving an "F" grade on the assignment in question or in the course overall. For further information, students should make themselves familiar with the relevant section of the LUMS student handbook.

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LECT	TOPICS	INSTRUCTOR	READING
1	Course overview; Foundations of Biochemistry	SAQ	Ch 1; p 1-44
2	Water, acids and bases; buffers	SAQ	Ch 2; p 47-74
3	Amino acids, peptides and proteins	SAQ	Ch 3; p 75-114
4	Three-dimensional structure of proteins	SAQ	Ch 4; p 115-156
QUIZ-1			
5	Protein function	SAQ	Ch 5; p 157-188
6	Enzymes - I	SAQ	Ch 6; p 189-242
7	Enzymes - II	SAQ	Ch 6; p 189-242
8	Protein folding and denaturation; Prions	SAQ	Handout
QUIZ-2			
9	Carbohydrates and glycobiology - I	SAQ	Ch 7; p 243-280
10	Carbohydrates and glycobiology - II	SAQ	Ch 7; p 243-280
11	Bioenergetics and biochemical reaction types	SAQ	Ch 13; p 505-542
12	Glycolysis	SAQ	Ch 14; p 543-586
13	TCA cycle; Oxidative phosphorylation	SAQ	Ch 19; p 731-798
14	Gluconeogenesis and pentose phosphate pathways	SAQ	Ch 14; p 543-586
MIDTERM EXAM			
15	Lipids	MS	Ch. 10; p 357-384
16	Lipids as signaling molecules, cofactors and pigments	MS	Ch 10; p 357-384
17	Lipid metabolism - I	MS	Ch 17; p 667-694
18	Lipid metabolism - II	MS	Ch 21; p 833-880
19	Biological membranes and transport - I	MS	Ch 11; p 385-432
QUIZ-3			
20	Biological membranes and transport - II	MS	Ch 11; p 385-432
21	Biosignaling - I	MS	Ch 12; p 433-459
22	Biosignaling - II	MS	Ch 12; p 433-459
23	Multivalent adapters; membrane rafts; gated ion channels - I	MS	Ch 12; p 460-500
24	Multivalent adapters; membrane rafts; gated ion channels - II	MS	Ch 12; p 460-500
QUIZ-4			
25	Nucleotides and nucleic acids	MS	Ch 8; p 281-312
26	DNA-based information technologies	MS	Ch 9; p 313-356
27	Principles of metabolic regulation	MS	Ch 15; p 587-632
28	Hormonal regulation and integration of mammalian metabolism	MS	Ch 23; p 929-976
FINAL EXAM			

TEXTBOOK
Lehninger, Principles of Biochemistry
Nelson and Cox, 6th edition, W. H. Freeman and Company, 2013