

Course Syllabus

1	Course title	Biochemistry
2	Course number	0308242
3	Credit hours	4 hrs (3 theory, 1 practical)
	Contact hours (theory, practical)	3 theory + 3 hours practical per week
4	Prerequisites/corequisites	Organic chemistry
5	Program title	Bachelor of Clinical Laboratory Sciences
6	Program code	0308
7	Awarding institution	University of Jordan
8	School	Science
9	Department	Clinical Laboratory Sciences
10	Course level	Second Year
11	Year of study and semester (s)	Second Semester 2023/2024
12	Other department (s) involved in teaching the course	none
13	Main teaching language	English
14	Delivery method	<input checked="" type="checkbox"/> Face to face learning <input type="checkbox"/> Blended <input type="checkbox"/> Fully online
15	Online platforms(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....
16	Issuing/Revision Date	2023/2024

18 Course Coordinator:

Name: Dr. Abbas Al-Momany, Ph.D
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19 Other instructors: None

Name:
 Office number:
 Phone number:
 Email:

20 Course Description:

Biochemistry course explores the basic principles of biochemistry and develops the student's appreciation and understanding of biological networks. This course concentrates on the acid-base chemistry (especially buffers) and the importance of water in our systems, and the chemistry and function of the major organic molecules in the cell which includes amino acids, proteins, enzymes, carbohydrates, lipids and vitamins. As well as energy metabolism

21 Course aims and outcomes:

A- Aims:

This is an introductory course which can provide the student with some basic knowledge on the structure, function and biochemical characteristics of the major biomolecules in human body.

B- Students Learning Outcomes (SLOs):

For purposes of mapping the course SLOs to the Clinical Laboratory Sciences program SLOs, at the successful completion of the program, graduates are expected to be able to:

SLO (1). Understand and apply the theoretical foundations of medical laboratory sciences to accurately calibrate and operate advanced laboratory equipment.

SLO (2). Demonstrate knowledge of safety protocols, Ministry of Health regulations, and environmental preservation practices when handling samples of pathogens and chemical/biological risks.

SOL (3). Acquire in-depth technical knowledge to stay abreast of scientific advancements and actively participate in local and global applied research in the field.

SOL (4). Perform diverse analyses and effectively interpret results for various clinical samples across laboratory disciplines such as hematology, clinical chemistry, microbiology, urine analysis, body fluids, molecular diagnostics, and immunology.

SOL (5). Apply practical training to solve complex problems, troubleshoot issues, and interpret results, ensuring a connection between data and specific medical conditions for precise diagnosis.

SOL (6). Show effective communication skills to convey information accurately and appropriately in a laboratory setting.

SOL (7). Demonstrate a commitment to lifelong learning and innovation by applying modern techniques, critically analyzing information, and contributing to the creation and application of new knowledge in medical laboratory sciences which fulfil the requirements of national and international CBD.

SOL (8). Uphold professional behavior, ensuring the confidentiality of client information, and respecting client privacy throughout all aspects of laboratory work.

SOL (9). Apply managerial skills that align with quality assurance, accreditation, quality improvement, laboratory education, and resource management, showcasing competence in the effective administration of laboratory practices.

Descriptors	ILO/ID	Program SLOs	SLO (1)	SLO (3)	SLO (4)	SLO (5)
		Course SLOs				
Knowledge	A1	Explain the structure and function of biological molecules, including proteins, nucleic acids, lipids, and carbohydrates.		X		
	A2	Apply fundamental chemical principles to biological systems, including acid-base chemistry		X		
	A3	Understand the principles of enzyme catalysis and kinetics. Analyze the factors affecting enzyme activity and regulation.		X		
	A4	Describe the major metabolic pathways, such as glycolysis, Krebs cycle, and oxidative phosphorylation.		X		
Skills	B1	Demonstrate proficiency in common biochemical laboratory techniques, including protein purification, and chromatography.			X	
	B2	To develop student's skills of identifying, describing, and using course concepts in related courses of medical laboratory sciences they need.				X
Competence	C1	Develop the ability to conceptualize, apply, analyze, synthesize and/or evaluate information gathered from, or generated by, observation experience reflection, reasoning, or communication.	X			
	C2	Integrate knowledge of biochemistry to propose potential diagnostic or therapeutic applications in medicine.		X		

22. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Introduction to Biochemistry	A1	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	1.2	Water and Polarity Hydrogen Bonds Acids, Bases, and pH	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
2	2.1	Titration Curves Buffers	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	2.2	Buffer Calculation	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	3.2	Amino acids Abbreviation Unusual AA AA derivatives	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
4	4.1	Ionization Donating and accepting proton Ionizing/titrating simple AA Ionizing AA with ionic R-group	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
	4.2	PKa values Peptide bonds Formation Polypeptide (N- & C-terminus) Interesting AA and polypeptides	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
5	5.1	Protein Structure/ function Primary- Sequence of AA Secondary – interaction between AA close in primary sequence Alpha helix Beta secondary sheet Turns Collagens triple helix Hydroxylysine and hydroxyproline	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	5.2	Fibrous and globular protein Tertiary structure Forces Example Myoglobin- heme oxygen binding Denaturation Refolding	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
6	6.1	Quaternary structure Hemoglobin Structure Oxygen Binding Bohr effect 2,3 PBG Fetal Hb	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	6.2	Enzymes Structure of enzyme Substrate Binding Location within the cell Intracellular and extracellular enzymes Properties of enzymes Nomenclature Classification of enzymes Cofactors and Coenzymes. Enzyme flexibility Mechanism of enzyme action Factors affecting rate of enzyme catalyzed reactions.	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
7	7.1	Enzyme kinetics Michaelis-Menten equation Turnover Number Perfect Enzymes Lineweaver-Burk plot	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	7.2	Enzyme activity regulation Control of enzyme quantity	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
		Altering the catalytic efficiency of the enzyme 1-Competitive inhibition 2-Non-competitive inhibition 3-Uncompetitive inhibition 4- Suicide inhibition						
8	8.1	Control of catalytic efficiency of enzymes Allosterism Covalent modification Access to substrate Control of enzyme synthesis/ breakdown.	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	8.2	Protein Purification Why purify a protein? Isolation of Intracellular Proteins Strategy for purification of a protein Salting in & out Differential Centrifugation Dialysis	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
9	9.1	Column Chromatography Ion-Exchange Chromatography Affinity chromatography Protein Electrophoresis Western Blot Enzyme-linked immunosorbent assay (ELISA)	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	9.2	Carbohydrates Definition Functions Classification Monosaccharides Disaccharides Oligosaccharides Polysaccharides	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
10	10.1	D- and L- configuration of carbohydrates Isomers and epimers Enantiomers Cyclization of monosaccharides Pyranose and furanose ring structures Naming glycosidic bonds Starch & Glycogen	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	10.2	Conjugated carbohydrate N- and O-glycosides Digestion of carbohydrates Absorption of monosaccharides by intestinal mucosal cells	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
		Glucose transport into intestinal cells						
11	11.1	Digestive enzyme deficiencies Lactose intolerance Sucrase-isomaltase complex deficiency Regulation of Blood Glucose Diabetes Mellitus The Glycemic Index	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	11.2	Metabolism Catabolic pathways (Hydrolysis of complex molecules) Anabolic pathways	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
12	12.1	Regulation of metabolism Signals from within the cell (intracellular) Communication between cells (intercellular) Second messenger systems Adenylyl cyclase GTP-dependent regulatory proteins Tyrosine kinase system	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	12.2	GLYCOLYSIS (Energy generation) Reactions of glycolysis Phosphorylation of glucose Properties of hexokinase and glucokinase	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
13	13.1	Regulation of glucokinase activity Regulation of PFK-1 Regulation of pyruvate kinase activity Pyruvate kinase deficiency	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	13.2	Tricarboxylic acid cycle Reactions of the TCA cycle Regulation of the pyruvate dehydrogenase complex	C1, C2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
14	14.1	Pyruvate dehydrogenase deficiency Energy produced by the TCA cycle Regulation of the TCA cycle	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	14.2	Electron transport chain & Oxidative Phosphorylation Organization of the chain Reactions of the electron transport chain Inhibitors of Electron Transport	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
		Chemiosmotic hypothesis						
15	15.1	Uncoupling proteins (UCP) Synthetic uncouplers Transport of reducing equivalents Glycerophosphate shuttle Malate-aspartate shuttle Inherited defects in oxidative phosphorylation	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
	15.2	Lipids biological significance of lipids Properties of Lipids Lipid Classification Fatty Acids Nomenclature Systems Delta Nomenclature Omega Nomenclature	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All
16		Compound lipids. Phospholipids Glycolipids Lipoprotein Digestion of Dietary lipids Control of lipid digestion Absorption of lipids by intestinal mucosal cells, or enterocytes Special adaptations for lipid digestion	A2, B1,B2	Face to Face	Lecture Room	Synchronous	Quiz, Exam	BIOCHEMISTRY Free for All

23 Evaluation Methods:

Opportunities to demonstrate achievement of the SLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
Midterm exam	30	Water, acid and bases, amino acids, protein structure, globular and fibrous proteins, enzymes, and Protein Purification	9	
Final exam	40	All chapters	Final week	

24 Course Requirements (e.g: students should have a computer, internet connection, webcam, account on a specific software/platform...etc):

Each student should have an internet connection, webcam and an account on the Microsoft teams.

25 Course Policies:

A- Attendance policies: Regular class attendance is expected, attendance is taken by Microsoft team program.

B- Absences from exams and submitting assignments on time: Reporting a valid reason of absence is accepted.

C- Health and safety procedures: All students should comply with the university health and safety procedures.

D- Honesty policy regarding cheating, plagiarism, misbehavior: All students should comply with the university Honesty policy regarding cheating, plagiarism, misbehavior.

E- Grading policy: Depends on the median value.

Midterm exam 30 %

Final Exam 40 %

Practical 30%

F- Available university services that support achievement in the course: internet access.

26 References:

A- Required book(s)

1. Richard A. Harvey & Denise R. Ferrier. Lippincott's Illustrated Reviews: Biochemistry 7th Edition, 2013. Textbook
2. Ahern, Rajagopal, and Tan, BIOCHEMISTRY Free for All, version 1.3
3. Campbell, Biochemistry 2ed edition, Saunders college publishing

Additional References:

Nelson and Cox, Lehninger: Principles of Biochemistry. 7th Edition, 2017.

Stryer, Lubert. Biochemistry. 8th Edition, 2015.

Voet, D and Voet J.G. Biochemistry, 4th Edition 2010.

Mathews and van Holde. Biochemistry. 2nd Edition, 1996.

B- Recommended books, materials, and media:

27 Additional information:

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Name of Course Coordinator: **Dr. Abbas Al-Momany**

Signature: *Abbas Al-Momany* Date:3/2024

Head of Curriculum Committee/Department: **Dr. Suzan Matar**

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Head of Department: **Dr. Ahmed Abu siniyeh**

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