



مركز الاعتماد  
وإضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER



**The University of Jordan**

**Accreditation & Quality Assurance Center**

**Course Syllabus**

**Course Name:**

|    |  |                                    |
|----|--|------------------------------------|
| 1  | Course title   | Biochemistry I for Dental Students |
| 2  | Course number  | 0541230                            |
| 3  | Credit hours (theory, practical)                     | 4, theory                          |
|    | Contact hours (theory, practical)                    | 4, theory                          |
| 4  | Prerequisites/corequisites                           | Organic Chemistry                  |
| 5  | Program title  | Doctor of Dental Surgery           |
| 6  | Program code   |                                    |
| 7  | Awarding institution                                 | The University of Jordan           |
| 8  | Faculty  | Medicine                           |
| 9  | Department   | Physiology and Biochemistry        |
| 10 | Level of course                                      | Second level                       |
| 11 | Year of study and semester (s)                       | Second year first semester         |
| 12 | Final Qualification                                  |                                    |
| 13 | Other department (s) involved in teaching the course |                                    |
| 14 | Language of Instruction                              | English                            |
| 15 | Date of production/revision                          | December 2018/2019                 |

#### 16. Course Coordinator:

*Office numbers, office hours, phone numbers, and email addresses should be listed.*

Dr. Nafez Abu Tarboush  
 School of Medicine, Third Floor  
 962-6-535-5000 (ext. 23414)  
[natarboush@ju.edu.jo](mailto:natarboush@ju.edu.jo), [nafzstarboush@yahoo.com](mailto:nafzstarboush@yahoo.com)

#### 17. Other instructors:

*Office numbers, office hours, phone numbers, and email addresses should be listed.*

Dr. Mamoun Ahram  
 Dr. Said Ismail  
 Dr. Diala Abu Hassan  
 Dr. Bilal Alazab

#### 18. Course Description:

*As stated in the approved study plan.*

This four-credit hour course is mandatory for second-year dental students. The course is designed to introduce dental students to biochemistry via covering the basic concepts of structures and functions of macromolecules, detailed information of enzymes, their mechanisms of action, regulation and their association to medicine, as well as cofactors critical for enzyme function. Also basic topics of molecular biology will be covered along with the basic molecular mechanisms and techniques applied.

**19. Course aims and outcomes:****A- Aims:**

The overall objective is to: 1) learn the structure of macromolecules and their building block, 2) know the chemical forces that determine their structure, and 3) link molecular structure to function of macromolecules.

**B- Intended Learning Outcomes (ILOs):** Upon successful completion of this course students will be able to ...

**A. Knowledge and Understanding:** Student is expected to

- A1- List common and most critical elements in the human body.
- A2- Differentiate the types and characteristics of non-covalent interactions.
- A3- Know biochemical importance and properties of carbon and water.
- A4- Recall the concepts of acids, bases, and amphoteric molecules, and ionization of water and weak acids.
- A5- Apply the molecular expressions: molarity, normality, equivalence, pH, and pKa.
- A6- Know the chemical concept of different types of buffers, buffering capacity, midpoint, and titration.
- A7- Apply the Henderson-Hasselbalch equation.
- A8- List of physiological buffers and translate knowledge in normal and abnormal condition.
- A9- Know the concepts macromolecules of and how they are synthesized and broken down.
- A10- Define carbohydrates.
- A11- Recognize the classifications, drawing, structure, and function of carbohydrates (mono-, di-, oligo-, and poly-).
- A12- Apply the concept of isomerism to monosaccharides.
- A13- Identify substituted and modified saccharides (mono- and poly-).
- A14- Differentiate proteoglycans and glycoproteins.
- A15- Link carbohydrates to blood typing.
- A16- Define lipids.
- A17- Identify the classifications, drawing, structure, and function of lipids (fatty acids, triglycerides, waxes, phospholipids, glycolipids, and steroids).
- A18- Differentiate the basic mechanism and players of lipid transport in blood.
- A19- Recall the complex structure of cell membranes and the function of the different components.
- A20- Define nucleic acids and nucleotides.
- A21- Identify the classifications, drawing, structure, and function of nucleic acids.
- A22- List modified nucleotides.
- A23- Define proteins.
- A24- List amino acids.
- A25- Differentiate the structure, isomerism, classes of amino acids.
- A26- Identify the ionization states of amino acids.
- A27- Know the concept of isoelectric point.
- A28- List modified and specialized amino acids.
- A29- Recall the four levels of protein structure.
- A30- Recall of features of peptide bond.
- A31- Apply the concept isoelectric point of amino acids to polypeptides.
- A32- Differentiate the different secondary structures of proteins and their structural significance.
- A33- Understand the formation of tertiary structure of proteins.
- A34- Define quaternary structure.
- A35- Know the concept of complex protein structures (glycoproteins, lipoproteins, phosphoproteins).
- A36- Apply the concepts of denaturation and renaturation to protein structure and function.
- A37- Apply the previous information to pathological defects in protein formation.
- A38- Apply the concepts and uses of different protein techniques (salting out and in, dialysis, chromatography (size-exclusion, ion-exchange, affinity, centrifugation, cell fractionation, isoelectric focusing, electrophoresis, immunoassays, protein sequencing, crystallography, and nuclear magnetic resonance).
- A39- Recognize the different classes of proteins (fibrous, globular).
- A40- Discuss different proteins from each class I (mainly collagen, myoglobin, and hemoglobin) in connection to their function in light of previous knowledge.
- A41- Define enzymes.
- A42- Recall the general properties and functions of enzymes.
- A43- List the classes of enzymes and differentiate the reactions they catalyze.
- A44- Recall the major features of active sites.

- A45- Differentiate types of enzyme-substrate interactions.
- A46- Recall the concept of free energy and activation energy.
- A47- Define enzyme kinetics.
- A48- Apply the concept of  $V_o$ ,  $V_{max}$ , and  $K_M$ , and their biological significance.
- A49- Apply the above terms to the Michaelis-Menten equation.
- A50- Apply the enzyme units ( $V_{max}$ , turnover number, specificity constant, rate of reaction ( $V_o$ ), enzyme activity, specific activity).
- A51- Link the mechanisms of action of the different classes of inhibitors in relation to the Lineweaver-Burk or double-reciprocal plot.
- A52- Know the role of the factor of diffusion (compartmentalization and enzyme complexing) in enzyme regulation.
- A53- Describe how enzyme activity can be regulated by physiological and pharmacological inhibitors.
- A54- Recall the concept of allosteric regulation.
- A55- Identify the role of small and large enzyme regulatory molecules.
- A56- Comprehend the mechanisms of reversible and irreversible enzyme modification.
- A57- Define modes of regulation.
- A58- Discuss the effect of nonspecific inhibitors (temperature, pH) on protein structure and function.
- A59- Define isoenzymes and know their biological and clinical significance.
- A60- Differentiate between holoproteins and apoproteins.
- A61- Differentiate classes of cofactors.
- A62- Define and list vitamins and understands their contribution in enzymatic reaction with emphasis on vitamin C, B vitamins, folic acid, and lipoic acid.
- A63- Identify the role of metals in enzyme activity of metal-activate enzymes.
- A64- Differentiate nucleotides and know their structures.
- A65- Recognize the mechanism of DNA and RNA structure and synthesis and their physical properties.
- A66- Explain the higher organization of DNA into chromosomes.
- A67- Comprehend the mechanism of DNA replication.
- A68- Recall the different major RNA molecules.
- A69- Know the processes of transcription and translation in prokaryotes and eukaryotes.
- A70- Identify the regulatory mechanisms of transcription and translation.
- A71- Identify the molecular players of carcinogenesis.
- A72- Get oriented of recombinant DNA technologies their use in diagnostics.
- A73- Recall the concept of gene therapy.
- A74- Recall the biology of stem cells.

**B. Intellectual Analytical and Cognitive Skills:** Student is expected to

- B1- Calculate pH and changes in pH according to different variables.
- B2- Predict changes in blood pH according to equilibrium of bicarbonate buffering system.
- B3- Differentiate between the various sugar molecules, lipids, and amino acids.
- B4- Calculate isoelectric point of small polypeptides.
- B5- Predict changes in enzyme kinetics according to inhibitor type.
- B6- Calculate enzyme activity.
- B7- Determine enzyme class according to catalyzed reaction and involved cofactor.
- B8- Interpret data of recombinant DNA technologies.

**20. Topic Outline and Schedule:**

| Topic  | No. of lectures | Week | Reference                                 | ILOs   |
|--|-----------------|------|---|--------|
| Introduction                                     | 1               | 1    | Campbell, Ch. 2, 35-43                    | A1-3   |
| Acids, bases, pH, and buffers                    | 3               | 1    | Campbell, Ch. 2, 44-56                    | A4-8   |
| Macromolecules and carbohydrates                 | 4               | 2    | Campbell, Ch. 1, 6-10<br>Campbell, Ch. 16 | A9-15  |
| Lipids   | 4               | 3    | Campbell, Ch. 8                           | A16-19 |
| Amino acids                                      | 2               | 4    | Campbell, Ch. 3                           | A20-22 |
| Polypeptides and protein structure               | 2               | 4    | Campbell, Ch. 3 and 4                     | A23-37 |
| Protein analysis                                 | 2               | 5    | Campbell, Ch. 5                           | A38    |
| Protein structure-function relationship (part I: | 1               | 5    | Campbell, Ch. 4, 90-93                    | A39-40 |

|  |   |        |                         |        |
|--|---|--------|-------------------------|--------|
| fibrous proteins)  |   |        |                         |        |
| Protein structure-function relationship (part II: globular proteins) | 4 | 5, 6   | Campbell, Ch. 4, 96-106 | A39-40 |
| Enzymes (introduction)   | 1 | 6      | Campbell, Ch. 6         | A41-45 |
| Enzymes (kinetics)   | 3 | 7      | Campbell, Ch. 6         | A46-51 |
| Enzymes (mechanism of regulation)                                    | 4 | 7, 8   | Campbell, Ch. 7         | A52-59 |
| Enzymes (cofactors)  | 2 | 8, 9   | External                | A60-63 |
| Nucleic acids structure  | 1 | 9      | Marks, Ch 12            | A64-66 |
| Replication, synthesis, and repair of DNA                            | 2 | 9      | Marks, Ch 13            | A67    |
| Transcription, synthesis of RNA                                      | 3 | 10     | Marks, Ch 14            | A68-70 |
| Translation, synthesis of proteins                                   | 4 | 10, 11 | Marks, Ch 15            | A68-70 |
| Regulation of Gene Expression  | 3 | 11, 12 | Marks, Ch 16            | A68-70 |
| Oncogenes and tumor suppressor & cancer                              | 3 | 12, 13 | Marks, Ch 18            | A71    |
| Recombinant DNA Technology   | 3 | 13, 14 | Marks, Ch 17            | A72    |
| Gene Therapy   | 1 | 14     | External Handout        | A73    |
| Stem cell technology   | 1 | 15     | External Handout        | A74    |

### 21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

Lectures (100%)

### 22. Evaluation Methods and Course Requirements:

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

Midterm Exam: 40%

Final exam: 60%

### 23. Course Policies:

Attendance policies:

Attendance is mandatory

B- Absences from exams and handing in assignments on time:

Make-up exam is given if absence is accepted by the deanship

C- Health and safety procedures:

None

D- Honesty policy regarding cheating, plagiarism, misbehavior:

Misbehavior is not permitted and is subjected to punishment according to university laws and regulations

E- Grading policy:

Exams are stored electronically

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

Lecture halls, computers, and data shows are provided

### 24. Required equipment:

Computers and data shows

**25. References:**

- A- Required book (s), assigned reading and audio-visuals:
- 1- Biochemistry; Mary K. Campbell and Shawn O. Farrell, Brooks Cole.
  - 2- Mark's Basic Medical Biochemistry, Smith, Marks and Lieberman, Lippincott, Williams and Wilkins.
- B- Recommended books, materials, and media:
- NCBI Bookshelf:  
(<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=Books>)
  - The Medical Biochemistry Page: (<http://web.indstate.edu/thcme/mwking/home.html>)
  - Biochemistry, Garret and Grishan, Second Ed.: <http://web.virginia.edu/Heidi/home.htm>

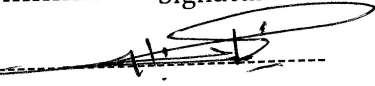
**26. Additional information:**

- Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.
- For more details on University regulations please visit:  
<http://www.ju.edu.jo/rules/index.htm>

Name of Course Coordinator: **Mamoun Ahram**

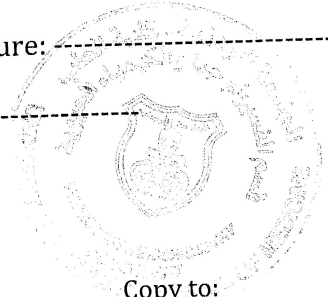
Signature: ----- Date 2022/2023

Head of curriculum committee/Department: ----- Signature: -----

Head of Department: د. نائل سنان Signature: 

Head of curriculum committee/Faculty: ----- Signature: -----

Dean: ----- Signature: -----



Copy to:  
Head of Department  
Assistant Dean for Quality Assurance  
Course File