Course E-Syllabus

1	**Course title**	Bioenergetics
2	**Course number**	0304921
3	**Credit hours**	3
	Contact hours (theory, practical)	3
4	**Prerequisites/corequisites**	--
5	**Program title**	PhD program-Biological Sciences
6	**Program code**	NA
7	**Awarding institution**	University of Jordan
8	**School**	Science
9	**Department**	Biological Sciences
10	**Level of course**	PhD
11	**Year of study and semester (s)**	First Semester/2020-2021
12	**Final Qualification**	PhD
13	**Other department (s) involved in teaching the course**	NA
14	**Language of Instruction**	English
15	**Teaching methodology**	☐Blended ☒Online
16	**Electronic platform(s)**	☒Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others……
17	**Date of production/revision**	12/2020

18 Course Coordinator:

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19 Other instructors:

Name:
Office number:
Phone number:
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Name:
Office number:
Phone number:
Email:

20 Course Description:

As stated in the approved study plan.

This course aims to inform students about energy metabolism in biological systems, starting from light the ultimate source of energy in this planet and ending with its export to its surrounding as entropy and light. It also discusses the various stages of energy transformation, transduction and conservation especially in ATP molecules and the mechanisms of its formation and its utilization in driving various cellular activities.
In this course also we discuss the process of photosynthesis and cellular respiration of main organic nutrients that reused as a source of energy which are carbohydrates, lipids and amino acids.

21 Course aims and outcomes:

A- Aims:

1. To apply the principles of thermodynamics to biochemistry.
2. To understand the common organic chemistry principles in biochemistry.
3. To provide students with the ability to differentiate between the "high energy" biomolecules with respect to their hydrolysis and group transfers.
4. To appreciate the energy stored in reduced organic compounds that can be used to reduce cofactors such as NAD^+ and FAD, which serve as universal electron carriers.
5. To increase the students' knowledge of the function of electron-transport chain in mitochondria and the chemiosmotic theory involved in ATP synthesis.
6. To comprehend the role of chloroplasts in capturing the energy of light.

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

Remember

1. Recall facts, terms, basic concepts, and information about common organic principles applied to biochemistry.
2. Describe the principle of thermodynamics involved in biological systems.

Understand

3. Discuss the function, structure of the complexes of the electron transport chain.
4. Describe how energy is captured by the reduced electron carries.
5. Discuss the main concepts of bioenergetics and oxidative phosphorylation

Apply

6. Outline a step-by-step approach to understand the ATP synthesis by mitochondria and chloroplasts.
7. Perform complex energy calculations to be applied on the biological reactions.

Analyze

8. Differentiate between the stages of ATP production.
9. Analyse the relation between the principles of thermodynamics and bioenergetics applied in biological systems.

22. Topic Outline and Schedule:

Week	Lecture	Topic	Teaching Methods*/platform	Evaluation Methods**	References
1	1.1	Introduction	Synchronous (MS Teams)	Midterm Exam	The references of lectures and presentations are listed below
	1.2				
	1.3				
2	2.1	Principles of thermodynamics: free-energy, entropy, enthalpy	Synchronous (MS Teams)	Midterm Exam	
	2.2				
	2.3				
3	3.1	Enzymes	Synchronous (MS Teams)	Midterm Exam	
	3.2				
	3.3				
4	4.1	ATP	Synchronous (MS Teams)	Midterm Exam	
	4.2				
	4.3				
5	5.1	Universal Electron Carriers	Synchronous (MS Teams)	Midterm Exam	
	5.2				
	5.3				
6	6.1	Principles of Oxidation-Reduction Reactions in Biological Systems	Synchronous (MS Teams)	Final Exam	
	6.2				
	6.3				
7	7.1	Stages of ATP Production-Oxidation of fuel molecules	Synchronous (MS Teams)	Final Exam	
	7.2				
	7.3				
8	8.1	Stages of ATP Production-Citric Acid Cycle	Synchronous (MS Teams)	Final Exam	
	8.2				
	8.3				
9	9.1	Oxidative Phosphorylation	Synchronous (MS Teams)	Final Exam	
	9.2				
	9.3				
10	10.1	Photosynthesis	Synchronous (MS Teams)	Final Exam	
	10.2				
	10.3				
11	11.1	Presentations by the students	Synchronous (MS Teams)		
	11.2				
	11.3				
12	12.1	Presentations by the students	Synchronous (MS Teams)		
	12.2				
	12.3				
13	13.1	Presentations by the students	Synchronous (MS Teams)		
	13.2				

	13.3				
14	14.1	Presentations by the students	Synchronous (MS Teams)		
	14.2				
	14.3				
15	15.1	**Final Exam**			
	15.2				
	15.3				

- Teaching methods include: Synchronous lecturing/meeting
- Evaluation methods include: Exam and Presentations of research topics.

23 Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	Period (Week)	Platform
Midterm Exam	30	Principles of thermodynamics: free-energy, entropy, enthalpy Enzymes ATP	6	Microsoft Forms
Presentations of the assigned research topics by the students	30		11-14	MS Teams
Final Exam	40	All topics	15	Microsoft Forms

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

Students should have:
- Computer
- Internet connection
- Webcam
- Active university account on Moodle (e-learning) website
- Active university account on Microsoft Teams

25 Course Policies:

A- Attendance policies:
As per the applicable university regulations

B- Absences from exams and submitting assignments on time:
As per the applicable university regulations

C- Health and safety procedures:
NA

D- Honesty policy regarding cheating, plagiarism, misbehavior:
As per the applicable university regulations

E- Grading policy:
As per the applicable school bylaw

F- Available university services that support achievement in the course:
Moodle (e-learning) website-MS Forms (exams)-Microsoft Teams institutional subscription

26 References:

A- Required book(s), assigned reading and audio-visuals:

Lippincott Illustrated Reviews: Biochemistry, 7th edition, by Denise Ferrier, 2017, ISBN/ISSN9781496344496

Lehninger Principles of Biochemistry, Seventh Edition, by David L. Nelson (Author), Michael M. Cox (Author), 2017, ISBN/ISSN: 978-1464126116

Campbell Biology, Urry, Eleventh Edition, 2018, ISBN: 10: 1-292-17043-3, 13: 978-1-292-17043-5

Recent published papers related to the different topics

B- Recommended books, materials and media:

27 Additional information:

Name of Course Coordinator: ------- Nancy Hakooz--------Signature: ---------- Date: 12-2020

Head of Curriculum Committee/Department: ---------- Signature: ----------

Head of Department: ---------- Signature: ----------

Head of Curriculum Committee/Faculty: ---------- Signature: ----------

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