



Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	265/2024/24/3/2
	The Date of the Deans Council Approval Decision	2024/1/23
	Number of Pages	06

1.	Course Title	Metabolism
2.	Course Number	0501223
3.	Credit Hours (Theory, Practical)	3 Theory
	Contact Hours (Theory, Practical)	43 Lectures
4.	Prerequisites/ Corequisites	
5.	Program Title	Doctor of medicine
6.	Program Code	0501118
7.	School/ Center	School of Medicine
8.	Department	Physiology and Biochemistry
9.	Course Level	Bachelor
10.	Year of Study and Semester (s)	Second year/ First Semester
11.	Program Degree	Bachelor
12.	Other Department(s) Involved in Teaching the Course	-
13.	Learning Language	English
14.	Learning Types	☐ Face to face learning ☒ Blended ☐ Fully online
15.	Online Platforms(s)	Moodle ☒ Microsoft Teams
16.	Issuing Date	2023
17.	Revision Date	5-10-2025

18. Course Coordinator:

Name: Dr. Diala Abu-Hassan Contact hours: Tuesdays 12.00pm-2.00pm and Wednesdays 11.00am- 1.00pm Office number: 136 Phone number: 065355000/23484 Email: d.abuhassan@ju.edu.jo
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**19. Other Instructors:**Name: **Prof. Nafez Abu Tarboush**Contact hours: **Mondays and Tuesdays 12:30-1:30; Thursday 10:30-11:30**

Office number:

Phone number: **065355000/23414**Email: n.abutarboush@ju.edu.jo**20. Course Description:**

As stated in the approved study plan.

A- Course Description:

This three-credit hour course is mandatory for second-year medical students. The course is preceded by biochemistry and molecular biology course where the introduction to biochemistry via covering the basic concepts of structures and functions of macromolecules has been given. In this course, a detailed description of the various metabolic processes will be given. This includes structure-function relationship of specific proteins, metabolism of energy, carbohydrates, lipids, proteins, and nucleic acids, followed by a brief material that covers nutrition and vitamins with respect to the human body in addition to integration of metabolic pathways.

B- Aims:

- 1) To learn the structure-function relationship of specific proteins.
 - 2) To know the various human metabolic processes that occur for different macromolecules.
- To compare metabolic pathways in different conditions and normal versus disease states.

21. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

Program Intended Learning Outcomes (PLOs) (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program):

PLO's	*National Qualifications Framework Descriptors*		
	Competency (C)	Skills (B)	Knowledge (A)
1.	☐	☒	☒
2.	☒	☒	☐
3.	☒	☐	☒
4.	☐	☐	☒
5.	☒	☒	☐



6.	☒	☒	☐
7.	☒	☐	☒
8.	☒	☐	☐

* Choose only one descriptor for each learning outcome of the program, whether knowledge, skill, or competency.

Program Intended Learning Outcomes:

1. Demonstrate basic knowledge of normal human structure and function at molecular, genetic, cellular, tissue, organ, system and whole-body levels in terms of growth, development, and health maintenance. Analyze the basic molecular and cellular mechanisms involved in the causation and treatment of human disease and their influence on clinical presentation and therapy.
2. Collect, interpret, document, and communicate accurately a comprehensive medical history, including the psychological and behavioral factors, and a thorough organ-system-specific physical examination inclusive of the mental status of the patient.
3. Integrate and communicate collected clinical information in the construction of appropriate diagnostic and therapeutic management strategies to identify life-threatening conditions ensuring prompt therapy, referral, and consultation with relevant disciplines and skillfully perform basic medical procedures for general practice on patients with common illness, acute and chronic, taking into account environmental, social, cultural and psychological factors.
4. Demonstrate in-depth knowledge of the epidemiology and biostatistics of common diseases, and analyze the impact of ethnicity, culture, socioeconomic factors and other social factors on health, disease, and individual patient's health care.
5. Communicate effectively and professionally, both orally and in writing, with patients, their families, and with other healthcare providers utilizing information technology resources in his/her scholarly activities and professional development with the ability to teach others, and to understand and respect other healthcare professionals' roles and apply the principles of multidisciplinary teamwork dynamics and collaboration.
6. Apply scientific methods including evidence –based approach to the medical practice including problem identification, data collection, hypothesis formulation, etc., and apply inductive reasoning to problem solving and ensure that clinical reasoning and decision making are guided by sound ethical principles.
7. Demonstrate knowledge of scientific research methods and ethical principles of clinical research and be able to write research proposals or research papers.



8. Demonstrate professionally the skills needed for Quality improvement, lifelong learning, and continuous medical education including the ability to identify and address personal strength and weakness, self-assess knowledge and performance, and develop a self-improvement plan.

22. Course Intended Learning Outcomes: (Upon completion of the course, the student will be able to achieve the following intended learning outcomes):

1. Understand and memorize the different reactions coenzymes and enzymes of the discussed metabolic pathways
2. Explain the differences in metabolism between different conditions.
3. Explain the differences in metabolism in normal state versus various diseases.
4. Differentiate between various metabolic pathways for each type of molecules
5. Predict the favorability of biochemical pathways.
6. Integrate carbohydrate, lipid and amino acid metabolic pathways.
7. Interpret data from biochemical calculations of human processes
8. Calculate the energy requirements for different reactions
9. Demonstrate an ability to link information and apply knowledge of basic metabolic pathways into a clinical setting

Course ILOs #	The learning levels to be achieved						Competencies
	Remember	Understand	Apply	Analyse	Evaluate	Create	
1.	✓	✓					1. Understand and memorize the different reactions coenzymes and enzymes of the discussed metabolic pathways
2.	✓	✓	✓	✓			2. Explain the differences in metabolism between different conditions.
3.	✓	✓	✓	✓	✓		3. Explain the differences in metabolism in normal



							state versus various diseases.
4.				✓	✓		4. Differentiate between various metabolic pathways for each type of molecules
5.				✓	✓		5. Predict the favorability of biochemical pathways.
				✓	✓	✓	6. Integrate carbohydrate, lipid and amino acid metabolic pathways.
				✓	✓	✓	7. Interpret data from biochemical calculations of human processes
				✓	✓	✓	8. Calculate the energy requirements for different reactions
				✓	✓	✓	9. Demonstrate an ability to link information and apply knowledge of basic



							metabolic pathways into a clinical setting
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23. The matrix linking the intended learning outcomes of the course -CLO's with the intended learning outcomes of the program -PLOs:

Program ILOs ILOs of the course	CLO (1)	CLO (2)	CLO (3)	CLO (4)	CLO (5)	CLO (6)	Descriptors**		
							A	B	C
PLO (1)	✓			✓			✓		
PLO (2)		✓	✓	✓				✓	
PLO (3)			✓	✓					✓
PLO (4)					✓		✓		
PLO (5)						✓		✓	
PLO (6)						✓			✓
PLO (7)		✓				✓	✓		
PLO (8)						✓			✓

***Linking each course learning outcome (CLO) to only one program outcome (PLO) as specified in the course matrix.**

****Descriptors are determined according to the program learning outcome (PLO) that was chosen and according to what was specified in the program learning outcomes matrix in clause (21).**



24. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome (SLO)	Descriptors **	Learning Types (Face to Face/Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1-1.3	Bioenergetics of the cell	-Understand the need for energy in the human body, list the phases of energy transformation, and be familiar with the different bioenergetics terms -Explain the concept of thermogenesis -Explain the concept of oxidation-reduction (Redox) reactions and differentiate between the different classes of enzymes responsible for them. Also be able to calculate the energy requirements from the redox potential -Understand the caloric value of different nutritional fuels -Explain the concept of energy balance	K K S K S	Face to face	MT	Synchronous Lecturing	Written exam	A+B
2	2.1-2.3	Energy Metabolism (TCA cycle)	-Be able to answer why do we need the TCA cycle, explain how different fuels get converted to Acetyl CoA with the detailed description of its fate in the TCA cycle -Understand and memorize the different reactions coenzymes and enzymes of the TCA cycle -Understand the concept of substrate level phosphorylation -Be able to calculate the bioenergetics of the TCA cycle and understand how it is regulated, know the intermediates in relation to amino acids and explain the concept of anaplerotic reactions	K K K S C	Face to face	MT	Synchronous Lecturing	Written exam	A+B
3	3.1-3.3	Energy Metabolism (Oxidative Phosphorylation)	-Define the oxidative phosphorylation process and know why do we need it -List the requirements of oxidative phosphorylation, and explain the concept of electrochemical potential gradient with the detailed description of the different oxidation reduction components of the electron transport chain -Know the proton pumping mechanism & role -Explain the structure, mechanism and role of ATP synthase -Understand the mechanism of oxidative phosphorylation blockers & uncouplers -Explain the classes of genetic diseases associated with the process	K K K K S C	Face to face	MT	Synchronous Lecturing	Written exam	A+B



4-7	4.1-4.3 5.1-5.3 6.1-6.3 7.1, 7.2	Carbohydrate metabolism & ROS	-Explain how carbohydrates get digested, absorbed, & transported -Explain glycolysis (reactions, regulation, energetic, disorders) -Know the metabolic fate of pyruvate under different conditions, reactions & enzymes involved in these processes -Explain gluconeogenesis (reactions, regulation, significance) -Explain glycogen metabolism: glycogenesis reactions, glycogenolysis reactions, significance, regulation, disorders -Explain the pentose phosphate pathway (reactions, regulation, significance, disorders) -Understand the concept of oxygen & reactive oxygen species -Discuss the effect of nitric oxide & reactive nitrogen-oxygen species, formation of free radicals during phagocytosis & inflammation, cellular defenses against oxygen toxicity -Know galactose metabolism & disorders associated -Know fructose metabolism & disorders associated -Know the synthetic pathway of lactose and glucuronic acid -Discuss blood glucose level & regulation	K S K K K K K K S C	Face to face	MT	Synchronous Lecturing	Written exam	A
7	Midterm Exam								
8-11	8.1-8.3 9.1-9.3 10.1-10.3 11.1	Lipid metabolism and lipid soluble vitamins	-Explain the general digestion & transport processes of dietary lipids -Explain the synthesis of chylomicrons, transport in blood & fate -Explain the synthesis of fatty acids, triacylglycerols, & the major membrane lipids -Explain the synthesis of triacylglycerols & VLDL particles, their storage & fate -Discuss the metabolism of glycerophospholipids & sphingolipids -Explain cholesterol absorption, transport, synthesis, metabolism & fate -Discuss eicosanoids (metabolism, sources, synthesis) -Discuss the integration of carbohydrate & lipid metabolism (regulation in the fed & fasting states)	K K K K K K S K	Face to face		Synchronous Lecturing	Written exam	A



11-12	11.2,11.3 12.1-12.3	Amino acids & protein metabolism	-Discuss protein metabolism (digestion, absorption & transport) -Define the concept of nitrogen balance -Know the amino acids pool & protein turn-over processes -Discuss protein degradation pathways -Explain the metabolism of the amino group in amino acids (pathways, transamination reactions, diagnostic value of plasma aminotransferases, the oxidative deamination reactions, transport of ammonia) -Describe the urea cycle in detail (reactions, enzymes, regulation, & diseases associated) -Explain the metabolism of the carbon skeleton in amino acids -List and discuss diseases & metabolic defects in amino acid metabolism	K K K K K K S C	Face to face		Synchronous Lecturing	Written exam	B
13	13.1,13.2	Conversion of amino acids to specialized products	-Know the conversion process of amino acids to specialized products (porphyrin, catecholamines, histamine, serotonin, creatine, melanin, glutathione) -Discuss porphyrin metabolism (structure, detailed synthesis & degradation of heme, jaundice & its types) -Know the general metabolism of catecholamines, histamine, serotonin, creatine, melanin, & glutathione	K K K S C	Face to face		Synchronous Lecturing	Written exam	A
13+14	13.3 14.1-14.2	Nucleic acid metabolism	-Explain nucleic acids digestion & absorption -Discuss the biosynthesis of purine nucleotides, DE NOVO and salvage pathways -Discuss the synthesis of deoxyribonucleotides -Discuss the biosynthesis of pyrimidine nucleotides, DE NOVO and salvage pathways -Explain the catabolism of purine & pyrimidine nucleotides, the significance of uric acid, & diseases associated with their metabolism	K K K K K S C	Face to face		Synchronous Lecturing	Written exam	A
14+15	14.3, 15.1	Integration of metabolism	-Integrate carbohydrate, lipid and amino acid metabolism in diabetes -Know the mechanism of insulin resistance -Distinguish the two types of diabetes -Integrate carbohydrate, lipid and amino acid metabolism in fasting versus well-fed state	S K K S	Face to face		Synchronous Lecturing	Written exam	A



				C					
15	15.2	Obesity	-Distinguish different types of obesity -Calculate body mass index -Know the hormonal and molecular players in obesity -Know the risk factors of Obesity	K S K K S C	Face to face		Synchronous Lecturing	Written exam	A
Final Exam									
** K: Knowledge, S: Skills, C: Competency									

25. Evaluation Methods:

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

Evaluation Activity	Mark	Topic(s)	CLOs	Descriptors**	Period (Week)	Platform
Midterm exam	40	Bioenergetics of the cell/Energy Metabolism (TCA cycle)/Energy Metabolism (Oxidative Phosphorylation)/Part of carbohydrate metabolism	1.1/ 1.2/1.3/ 2.1/ 2.2/2.3/ 3.1/ 3.2/3.3/ 4.1/ 4.2/4.3/ 5.1/ 5.2/5.3/6.1/6.2/6.3	K S C	8 th week	Paper-based exam
Final exam	60	Part of carbohydrate metabolism and ROS/Lipid metabolism and lipid soluble vitamins/Amino acids & protein metabolism/Conversion of amino acids to specialized products/Nucleic acid metabolism/Integration of metabolism/Obesity	7.1/7.2/7.3/8.1/8.2/8.3/9.1/ 9.2/9.3 10.1/ 10.2/10.3/ 11.1/ 11.2/11.3/ 12.1/ 12.2/12.3/ 13.1/ 13.2/13.3/ 14.1/ 14.2/14.3/15.1/15.2	K S C	15 th -16 th week	Paper-based exam
** K: Knowledge, S: Skills, C: Competency						

* According to the instructions for granting a Bachelor's degree.

**According to the principles of organizing semester work, tests, examinations, and grades for the bachelor's degree.

**Mid-term exam specifications table***

(Tables below are completed on separate forms by course coordinators prior to conduction of each exam according to Accreditation and Quality Assurance Centre procedures and forms)

No. of questions/ cognitive level						No. of questions per CLO	Total exam mark	Total no. of questions	CLO/ Weight	CLO no.
Create %10	Evaluate %10	analyse %10	Apply %20	Understand %20	Remember %30					
1	1	1	4	2	1	10	100	100	10%	1

Final exam specifications table

No. of questions/ cognitive level						No. of questions per CLO	Total exam mark	Total no. of questions	CLO Weight	CLO no.
Create %10	Evaluate %10	analyse %10	Apply %20	Understand %20	Remember %30					
										1

26. Course Requirements:

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

- ✓ **Class room Lectures**
- ✓ **Internet connection**

27. Course Policies:**A- Attendance policies:**

Attendance will be monitored by the course coordinator. Attendance policies will be announced at the beginning of the course.

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

Will be managed according to the University of Jordan regulations. Refer to <http://registration.ju.edu.jo/Documents/daleel.pdf>

C- Health and safety procedures:

Faculty Members and students must at all times, conform to Health and Safety rules and procedures.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this course and also integrity in your behavior in and out of the classroom. Students violate this policy would be subjected to disciplinary action according to University of Jordan disciplinary policies

E- Grading policy:



Grade-point average, Rules are preset by the Faculty and Department Councils

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

Availability of comfortable lecture halls, data show, internet service and E learning website <https://elearning.ju.edu.jo/>

28. References:

- A- Required book (s), assigned reading and audio-visuals:
Lippincott's illustrated reviews, Biochemistry, 6th edition
- B- Recommended books, materials, and media:
Marks' Basic Medical Biochemistry: A Clinical Approach, 3rd Edition

29. Additional information:



Name of the Instructor or the Course Coordinator: Dr Diala Abu Hassan	Signature: 	Date: 17/7/2025
Name of the Head of Quality Assurance Committee/ Department Dr Enas AL- Zayadne	Signature:	Date:
Name of the Head of Quality Assurance Committee/ School or Center Professor Ayman Wahbeh	Signature:	Date:
Name of the Dean or the Director Professor Ayman Wahbeh	Signature:	Date: