Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory Medicine.

Department of Biochemistry and Molecular biology
Course Specification of Analytical Biochemistry II
Course No. (03.11.317)
2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr\ Nawal Al- Henhena	Dr. Nabil Alowiri	DrNawal Al- Henhena	Dr\Gamil Taher Abdul-Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:

1	**Course Title:**	Analytical Biochemistry II			
2	**Course Code & Number:**	03.11.317			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	Practical	**Credit Hours**
		2	0	2	3
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 2nd Semester			
5	**Pre –Requisite (if any):**	None			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Master Degree Biochemistry and Molecular biology			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Regular			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**				
13	**Date of Approval:**	2023			

II. Course Description:
Course Description: This course is an advanced study of the principles and techniques used to analyze biological molecules. Topics covered include: Chromatography, Spectroscopy, Mass spectrometry, Immunoassays, and Biosensors.

III. Alignment Course Intended Learning Outcomes with program outcomes

	III. Course Intended Learning Outcomes (CILOs)	Referenced PILOs
A. Knowledge and Understanding: *Upon successful completion of the course, students will be able to:*		
a1	**Understanding** of instruments techniques and principles of chromatography, electrophoresis, mass spectrometry, nuclear magnetic resonance spectroscopy, biosensors, and imaging techniques	A1
B. Intellectual Skills: *Upon successful completion of the course, students will be able to:*		
b1	**Interpret** analytical data	B1
C. Professional and Practical Skills: *Upon successful completion of the course, students will be able to:*		
c1	**Perform** a wide variety of biochemical an molecular techniques	C1
D. Transferable Skills: *Upon successful completion of the course, students will be able to:*		
d1	**Communicate** scientific concepts and findings effectively in written and oral formats	

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr\ Nawal Al- Henhena	Dr. Nabil Alowiri	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

IV. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods:

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1	**Understanding** of instruments techniques and principles of chromatography, electrophoresis, mass spectrometry, nuclear magnetic resonance spectroscopy, biosensors, and imaging techniques	Lectures	exam

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1	**Interpret** analytical data	Lectures Laboratory practical	Exam

C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1	**Perform** a wide variety of biochemical an molecular techniques	Lectures Laboratory practical	Exam Lectures Laboratory practical

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1	**Communicate** scientific concepts and findings effectively in written and oral formats		

NO.	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes (CILOs)
1	Electrophoretic techniques	General principle, factors affecting electrophoresis, (electrical field, sample, buffer, sampling medium), low voltage (paper, cellulose acetate, thin-layer electrophoresis), high voltage (gel, SDS, isoelectric focusing, preparative electrophoresis), detection, recovery, estimation	3	6	a1,b1,c1,d1
2	Spectroscopic techniques	General principle, Types of spectra and their biochemical usefulness, UV spectra, Infra-red, spectrofluorimetry, Luminometry, Atomic and flame spectrophotometry, Electron spin resonance spectrometry, NMR, Mass spectroscopy	3	6	a1,b1,c1,d1
3	Radioisotope Techniques	The nature of radioactivity , types of radioactive decay, rate of radioactive decay interaction of radioactivity with matter, detection and measurement of radioactivity (based upon gas ionization, based upon excitation), types of scintillation counting, advantages & disadvantages of scintillation counting, determination of counting efficiency applications of radioisotopes in the biological sciences, analytical applications, Safety aspects of the use of radioisotopes.	3	6	a1,b1,c1,d1
4	Electrochemical techniques	The range of electrochemical techniques, reference electrodes, measurement of pH by glass electrodes, ion-selective electrodes and gas sensors, oxidation-reduction potentials, the oxygen electrode, biosensors, electrochemical detectors.	3	6	a1,b1,c1,d1
5	Cell culture techniques	Advantages of cell culture, primary culture cells Vs. cell lines, types of established cell lines, requirements and type of cell culture media, assessing cell cultures, sub-culturing cells.	3	6	a1,b1,c1,d1
5	final exam		1	2	a1,b1,c1,d1
Number of Weeks /and Units Per Semester			16	32	

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V. Teaching Strategies of the Course:	
1-	Lectures
2-	Seminars

VI. Assessment Methods of the Course:	
No	Assignment
1	Written Exams (Essays) and Quizzes
2	Structured Oral Exams
4	Objective Structured Practical Exams (OSPE)
5	Student presentation
6	Case study analysis

VII. Assignments:

No.	Assignments	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs (symbols)
2	Activity	Throughout the semester	20	20%	a1,b1,c1,d1
5	Final Exam		80	80%	a1,b1,c1,d1
Total			100		

Learning Resources:

- *Written in the following order. (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology-Robert H. Carman. 2nd Edn. CMAI, New Delhi

2- Essential References.

- Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. Bhalani Publication.
- Handbook of Biochemistry by M. A. Siddique 8th Edn. Vijay Bhagat Scientific Book

Wep

1. Ebook link- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalbiochemistry.pdf
2. Ebook link- https://books.google.co.in/books?id=Je_pJfb2r0cC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. Ebook link- https://books.google.co.in/books?id=csPcDAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
4. Ebook link- https://books.google.co.in/books?id=2FkXAwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr\ Nawal Al- Henhena	Dr. Nabil Alowiri	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

XI. *Course Policies:*	
1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration

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Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory Medicine.

Department of Biochemistry and Molecular biology
Course Specification of Advanced Biochemistry I
Course No. (03.11.312)
2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr. Nabil Alowiri	Dr. Ebtesam Al-Zabedi	Dr. Nawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:					
1	**Course Title:**	Advanced Biochemistry I			
2	**Course Code & Number:**	**03.11.312**			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	**Practical**	**Credit Hours**
		2	0	0	2
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 1st Semester			
5	**Pre –Requisite (if any):**	None			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Master Degree Biochemistry and Molecular biology			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Regular			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**	Dr. Nabil Alowiri			
13	**Date of Approval:**	2023			

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr. Nabil Alowiri	Dr. Ebtesam Al-Zabedi	Dr. Nawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

II. Course Description:

The focus is on the regulation of sugar and fat metabolism in eukaryotes, with an emphasis on human. The course will begin with a review of carbohydrate and lipid metabolic pathways, particularly pathway integration and regulation. We will then progress to an in-depth analysis of current research in specific areas of nutritional sensing, signaling and metabolic regulation.

III. Alignment Course Intended Learning Outcomes with program outcomes

	III. Course Intended Learning Outcomes (CILOs)	Referenced PILOs
A. Knowledge and Understanding: *Upon successful completion of the course, students will be able to:*		
a1	**Demonstrate** knowledge and understanding of the principles that govern the structures of macromolecules and their metabolic pathways	A1
B. Intellectual Skills: *Upon successful completion of the course, students will be able to:*		
b1	**Explain** the structure, functions, and metabolism of lipids in the living system	B2
C. Professional and Practical Skills: *Upon successful completion of the course, students will be able to:*		
c1	**Apply** theoretical and practical aspects of enzyme kinetics, inhibition, mechanisms, and regulation.	C1
D. Transferable Skills: *Upon successful completion of the course, students will be able to:*		

C. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods:			
(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
A1	**Demonstrate** knowledge and understanding of the principles that govern the structures of macromolecules and their metabolic pathways	Lectures	Exams
(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
B1	**Explain** the structure, functions, and metabolism of lipids in the living system	Lectures	Exams, Assignments.
C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
C1	**Apply** theoretical and practical aspects of enzyme kinetics, inhibition, mechanisms, and regulation.	Lectures Practical sessions	Lab reports, Exams
(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:			
	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies

NO.	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes (CILOs)
1	**Carbohydrate metabolism in muscle, adipose tissue and liver**	- Glycolysis, various forms of fermentations in micro-organisms, citric acid cycle, its function in energy generation and biosynthesis of energy rich bond, pentose phosphate pathway and its regulation. - Gluconeogenesis, glycogenesis and glycogenolysis, glyoxylate and Gamma aminobutyrate shunt pathways, Cori cycle, anaplerotic reactions, Entner-Doudoroff pathway, glucuronate pathway. - Metabolism of disaccharides. - Hormonal regulation of carbohydrate metabolism. - Energetics of metabolic cycle. - Carbohydrates metabolic disorders	5	10	a1,b1,c1
2	**lipid metabolism in adipose tissue and**	- Introduction, hydrolysis of tri-acylglycerols, α-, β-, ω- oxidation of fatty acids. - Oxidation of odd numbered fatty acids – fate of propionate, role of carnitine, degradation of complex lipids. - Fatty acid biosynthesis, Acetyl CoA carboxylase, fatty acid synthase, ACP structure and function, Lipid biosynthesis, biosynthetic pathway for tri-acylglycerols, phosphoglycerides, sphingomyelin and prostaglandins. - Metabolism of cholesterol and its regulation. - Energetics of fatty acid cycle	5	10	a1,b1,c1
3	**Protein metabolism and Nucleic acid metabolism**	- General reactions of amino acid metabolism = Transamination, decarboxylation, oxidative & non-	5	10	a1,b1,c1

		oxidative deamination of amino acids. - Special metabolism of methionine, histidine, phenylalanine, tyrosine, tryptophan, lysine, valine, leucine, isoleucine and polyamines. Urea cycle and its regulation. - Biosynthesis and degradation of purine and pyrimidine ribonucleotides, formation of deoxy ribonucleotides and their regulation			
4	**Final Exam**		**1**	**2**	
Number of Weeks /and Units Per Semester			**16**	**32**	

V. Teaching Strategies of the Course:

1-	Lectures
2-	Practical session
3-	Self-leaning
4-	**Group research**

VI. Assessment Methods of the Course:

No	Assignment	
1	**Written Exams (Short Essays) and Quizzes**	
2	Written Exams(MCQ)	
3	Structured Oral Exams	
4	Objective Structured Practical Exams (OSPE)	
5	Student presentation	

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr. Nabil Alowiri	Dr. Ebtesam Al-Zabedi	Dr. Nawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

VII. Assignments:

No.	Assignments	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs (symbols)
2	Activity	Throughout the semester	20	20%	a1,b1,c1
5	Final Exam		80	80%	a1,b1,c1
Total			100		

Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

Devlin, T.M., John Wiley & Sons, (2011) , Biochemistry with Clinical Correlations -7th ed., Inc. (New York), ISBN: 978-0-470-28173-4.

2- Essential References.

Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414- 8.

3- Electronic Materials and Web Sites *etc.*

1- Metabolism – clinicaland Experimental: https://metabolismjournal.com
2- The World Health Organization (WHO): https://www.who.int/

XI. *Course Policies:*

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr. Nabil Alowiri	Dr. Ebtesâm Al-Zabedi	Dr. Nawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration

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Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS &

APPLIEED SCIENCES

Faculty of Laboratory Medicine.

Department of Biochemistry and Molecular biology

Course Specification of Comparative Biochemistry
Course No. (03.11. 313)
2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
- Dr. Ebtesam Mahdi Al-Zabedi	Dr\ DrNawal Al-Henhena	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Maghni	- Associate Prof. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:						
1	**Course Title:**	Comparative Biochemistry				
2	**Course Code & Number:**	03.11. 313				
3	**Credit Hours:**	**Theory Hours**				
		Lecture	**Exercise**	Practical	**Credit Hours**	
		2	0	0	2	
4	**Study Level/ Semester at which this Course is offered:**	1st Semester				
5	**Pre –Requisite (if any):**	None				
6	**Co –Requisite (if any):**	None				
7	**Program (s) in which the Course is Offered:**	Master degree of Clinical Biochemistry & Molecular Biology				
8	**Language of Teaching the Course:**	English				
9	**Study System:**	semester				
10	**Mode of Delivery:**	Lecture				
11	**Location of Teaching the Course:**	University Campus				
12	**Prepared by:**	Dr. Ebtesam Al- Zabedi				
13	**Date of Approval:**	2023				

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
- Dr. Ebtesam Mahdi Al-Zabedi	Dr\ DrNawal Al-Henhena	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

	A. II. Course Description:
	This course provides an in-depth study of the major structure of plasma membrane, Carbohydrates lipid proteins ,types of transport across the membrane and membrane variations and pathology

III. Alignment Course Intended Learning Outcomes with program outcomes		
III. Course Intended Learning Outcomes (CILOs)		**Referenced PILOs**
A. Knowledge and Understanding: ***Upon successful completion of the course, students will be able to:***		
a1	**Undestaand** the basic structure and function of plasma membrane, types of transport, electrochemical gradient of protons and ATP synthesis, genetic variation and genetic diseases, drugs that act on the membrane	**A1**
B. Intellectual Skills: ***Upon successful completion of the course, students will be able to:***		
b1	**Explain** the mechanism of detoxification of lipid soluble substances	**B1**
C. Professional and Practical Skills: ***Upon successful completion of the course, students will be able to:***		
c1	**Perform** diagnostic laboratory tests in clinical biochemistry and genetic molecular	**C1**
D. Transferable Skills: ***Upon successful completion of the course, students will be able to:***		
d1	**Demonstrate** oral and written effective communication skills	**a1,a4,b1,b3,c2,d3**

C. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods:

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
A1	**Undestaand** the basic structure and function of plasma membrane, types of transport, electrochemical gradient of protons and ATP synthesis, genetic variation and genetic diseases, drugs that act on the membrane	Lectures	Exams
A2	**Discuss** the genetic variation and genetic diseases, drugs that act on the membrane	Lectures	Exams

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
B1	**Explain** the mechanism of detoxification of lipid soluble substances	Lectures	Exams, Assignments
B2	**Describe the deferent types of toxins and venoms and their sources**	Lectures	Exams, Assignments, Lab reports

C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
C1 C2	**Perform** diagnostic laboratory tests in clinical biochemistry and genetic molecular	Lectures Practical sessions	Lab reports, Exams

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
D1	**Demonstrate** oral and written effective communication skills		

III. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	week	contact hours	Learning Outcomes
1	General structure and composition of plasma membrane	Crbohydrates,lipid and protein ,mosaic model of structure, Cytoskelatole structures, Ion distribution,Electro-chemical gradientof protons,electron transport in mitochondrial membrane& ATP production	5	10	a1,a2,b1,b 2,c1,c2,d1
2	Lysosomes, secretion, exocytosis& endocytosis	Protein trafficking mechanism,Processing and packaging of products Membrane interaction during exocytosis, Other mechanisms ..phagocytosis, pinocytosis, lysosomes	4	8	a1,a2,b1,b 2,c1,c2,d1
3	Membrane variation	-Variable between membranes, genetic variability - Cell proliferation& differentiation, membrane fusion, Detoxification of heavy metals, lipid-soluble materials - Blood detoxificationby membrane - Venom's and toxins	4	8	a1,a2,b1,b 2,c1,c2,d1
4	membrane pathology	Genetic diseases of membrane Laddle's syndrome, cystic fibrosis, thalasemia, transport defect, lysosomal storage diseases, erythrocyte disorders, spectrine and protein abnormalities, Duchene muscular dystrophyand other defects	3	6	a1,a2,b1,b 2,c1,c2,d1
14	Final exam				
	Number of Weeks /and Units Per Semester		16	32	

V. Teaching Strategies of the Course:	
1-	Lectures
2-	Seminars

VI. Assessment Methods of the Course:	
No	**Assignment**
1	**Written Exams (Essays) and Quizzes**
3	Oral Exams
5	Student presentation

VII. Assignments:

No.	Assignments	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs (symbols)
2	**Activity**	Throughout the semester	20	20%	a2,a4.b1,b2,c1,c2,d3
5	**Final Exam**		80	80%	a2,a4.b1,b2,c1,c2,d3
Total			**100**		

IX. Learning Resources:

· *Written in the following order: (Author - Year of publication – Title – Edition - Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1- Devlin-Textbook of Biochemistry with Clinical Correlations-John Wiley & Sons (2010)

2- Harper's Illustrated Biochemistry 32 edition

2- Essential References.

1- Lehninger-Principles-of-Biochemistry fourth edition- David L. Nelson & Michael M.Cox

Molecular Biology of the Cell: Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter, 2014,6 edition

3- Electronic Materials and Web Sites *etc.*

1- The National Center for Biotechnology Information (NCBI) – https://www.ncbi.nlm.nih.gov/

2- The Protein Data Bank (PDB) - https://www.rcsb.org/

3- The European Molecular Biology Laboratory (EMBL) - https://www.embl.org/

4 The American Society for Biochemistry and Molecular Biology (ASBMB) - https://www.asbmb.org/ -

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
- Dr. Ebtesam Mahdi Al-Zabedi	Dr\ DrNawal Al-Henhena	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

XI. *Course Policies:*	
1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration

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- Dr. Ebtesam Mahdi Al-Zabedi	Dr\ DrNawal Al-Henhena	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory Medicine.

Department of Biochemistry and Molecular biology
Course Specification of Cellular and Molecular Biology
Course No. (03.11.314)
2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
- Dr. Nabil Alqwiri	Dr\ Nawal AL-Henhena	Dr/ Nawal AL-Henhena	Dr\Gamil Taher Abdil Mughni	- Associate Prof. Dr Ebtesam Al-Zabedi

I. Course Identification and General Information:

1	**Course Title:**	Cellular and Molecular Biology			
2	**Course Code & Number:**	03.11.314			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	Practical	**Credit Hours**
		2	0	2	3
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 1st Semester			
5	**Pre –Requisite (if any):**	None			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Master Degree Biochemistry and Molecular biology			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Regular			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**	Dr. Nabil Alowiri			
13	**Date of Approval:**	2023			

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
- Dr. Nabil Alowiri	Dr\ Nawal Al-Henhena	Dr/ Nawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

II. Course Description:

This course provides an introduction to the principles and techniques of molecular biology and genetics. Topics covered include DNA structure and replication, gene expression, regulation of gene expression, DNA repair, mutagenesis, cloning, and genetic engineering.

III. Alignment Course Intended Learning Outcomes with program outcomes

	III. Course Intended Learning Outcomes (CILOs)	Referenced PILOs
A. Knowledge and Understanding: *Upon successful completion of the course, students will be able to:*		
a1	**Understand** the basic principles of molecular biology and genetics	A1
a2	**Describe** the different methods of molecular cloning and different methods of genetic engineering	A2
B. Intellectual Skills: *Upon successful completion of the course, students will be able to:*		
b1	**Design** and carry out molecular biology and genetic experiments	B1
C. Professional and Practical Skills: *Upon successful completion of the course, students will be able to:*		
c1	**Isolate and purify** DNA and RNA from different sources, check of purity of isolated DNA and RNA, restriction fragmentation and separation of oligos by agarose electrophoresis, RAPD analysis of DNA, cDNA synthesis using PCR, Southern and Northern blotting experiments.	C1
D. Transferable Skills: *Upon successful completion of the course, students will be able to:*		
d1	**Demonstrate** oral and written effective communication skills	

C. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods:

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
A1	Understand the basic principles of molecular genetics and genetic disorders	Lectures	Exams
A2	**Discuss** the genetic variation and genetic diseases, drugs that act on the membrane	Lectures	Exams

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
B1	**Design** and carry out molecular genetic experiments	Lectures	Exams, Assignments

C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
C1	**Isolate and purify** DNA and RNA from different sources, check of purity of isolated DNA and RNA, restriction fragmentation and separation of oligos by agarose electrophoresis, RAPD analysis of DNA, cDNA synthesis using PCR, Southern and Northern blotting experiments..	Lectures Practical sessions	Lab reports, Exams

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
D1	**Demonstrate** oral and written effective communication skills	Lectures Practical sessions	Lab reports, Exams

NO.	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes (CILOs)
1	Introduction to Cell	- An overview of the cell and cell structure - Membrane biology - Major cell functions - Regulation of cell functions	1	2	a1,a2,b1,c1,d1
2	Nucleic acids	- Types of nucleic acids - DNA structure and function - RNA structure, types, and function	1	2	a1,a2,b1,c1,d1
3	Genome organization: from nucleotides to chromatin	- Eukaryotic genome - Bacterial genome and Plasmids - Bacteriophages and mammalian DNA viruses - Mitochondrial genome - Definition of a gene, gene structure, chromosomal organization of genes and noncoding DNA	1	2	a1,a2,b1,c1,d1
4	DNA replication	- Models of replication - Initiation of replication - Elongation of replication - Termination of replication - Proofreading of DNA - DNA replication in prokaryotes and Eukaryotes	1	2	a1,a2,b1,c1,d1
5	Gene expression - Transcription	- Transcription in prokaryotes and eukaryotes - Regulatory region and transcriptional unit of Gene - Inhibitors of transcription - Reverse transcription. - Post-transcriptional processing of RNA: splicing, cap addition and polyadenylation - Polynucleotide phosphorylase.	1	2	a1,a2,b1,c1,d1
6	Gene expression	- General features of the genetic code	1	2	a1,a2,b1,c1,d1

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	- **Translation and Post-translational modifications**	- Ribosome as the site of protein synthesis - Activation of amino acids - Initiation, elongation and termination of protein synthesis in prokaryotes and eukaryotes - Fidelity of protein synthesis - Bioenergetics of protein synthesis - Control of translation. - Post-translational processing of the polypeptide chains - Acylation, methylation, phosphorylation and glycosylation.			
7	**DNA repair and mutations**	- General classes of DNA damage - Mechanisms of DNA repair - Types of mutations and their phenotypic consequences	1	2	a1,a2,b1,c1,d1
8	Molecular biology techniques - **Analysis of Individual DNA and RNA Sequences**	- Molecular Cloning - Restriction Enzymes - Vectors - Plasmids - Libraries - Screening Libraries with Nucleic Acid - Probes	2	4	a1,a2,b1,c1,d1
9	Molecular biology techniques - **Methods of Nucleic Acid Analysis and Proteins**	- Southern Blotting - Northern or RNA Blotting - Western Blot Analysis of Proteins	1	2	a1,a2,b1,c1,d1
10	Molecular biology techniques - **The Polymerase Chain Reaction (PCR)**	- Conventional PCR - Modifications of PCR method - RT-PCR - Gel Electrophoresis - Real time PCR (qPCR) - Primers and primer Design - Applications of PCR	2	2	a1,a2,b1,c1,d1
11	Molecular biology techniques	- Introduction - Sequencing Methods and	2	4	a1,a2,b1,c1,d1

	- DNA Sequence Analysis	Terminology - Sanger Sequencing - Second/Next Generation Sequencing - Pyrosequencing -			
12	Molecular biology techniques - Advanced Techniques	- Fluorescence in Situ Hybridization - Comparative Genome Hybridization - RNA Expression Arrays	1	2	a1,a2,b1,c1,d1
13	Final Exam		1	2	
	Number of Weeks /and Units Per Semester		16	32	

V. Teaching Strategies of the Course:

1-	Lectures
2-	Practical session
3-	Self-leaning
4-	Group research

VI. Assessment Methods of the Course:

No	Assignment	
1	Written Exams (Short Essays) and Quizzes	a2,a4.b1,b2,c1,c2,d3
2	Written Exams(MCQ)	a2,a4.b1,b2,c1,c2,d3
3	Structured Oral Exams	a2,a4.b1,b2,c1,c2,d3
4	Objective Structured Practical Exams (OSPE)	a2,a4.b1,b2,c1,c2,d3
5	Student presentation	a2,a4.b1,b2,c1,c2,d3

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
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VII. Assignments:

No.	Assignments	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs (symbols)
2	Activity	Throughout the semester	20	20%	a2,a4.b1,b2,c1,c2,d3
5	Final Exam		80	80%	a2,a4.b1,b2,c1,c2,d3
Total			100		

Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

Lizabeth A. Allison – 2007 - Textbook of Fundamental molecular biology - Blackwell Publishing Ltd

2- Essential References.

1- WILLIAM B. COLEMAN and GREGORY J. TSONGALIS – 2010 - MOLECULAR DIAGNOSTICS – SECOND EDITION - SPRINGER NEW YORK DORDRECHT HEIDELBERG LONDON
2- Asklepios Bratislava – 2010 - INTRODUCTION TO MEDICAL AND MOLECULAR BIOLOGY -

3- Electronic Materials and Web Sites *etc.*

1- Harvard Molecular & Cellular Biology
2- Kimball's Biology Pages
3- Genetic Engineering and Biotechnology News

XI. *Course Policies:*

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** -If the student dose not attend for more than 6 times, the student will be obligated to withdrew from the course
3	**Exam Attendance/Punctuality:**

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	No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration

Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY of MEDICALS & APPLIEED

SCIENCES

Faculty of Laboratory medicine.

Department of Biochemistry and Molecular biology
Course Specification of Analytical Biochemistry I
Course No. (03.11.311)
2022/2023

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
Dr\ Nawal Al- Henhena	Dr. Nabil Alowiri	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

I. Course Identification and General Information:

1	**Course Title:**	Analytical Biochemistry I			
2	**Course Code & Number:**	**03.11.311**			
3	**Credit Hours:**	**Theory Hours**			
		Lecture	**Exercise**	Practical	**Credit Hours**
		2	0	0	2
4	**Study Level/ Semester at which this Course is offered:**	1st Level / 1st Semester			
5	**Pre –Requisite (if any):**	None			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Master Degree Biochemistry and Molecular biology			
8	**Language of Teaching the Course:**	English			
9	**Study System:**	Semester			
10	**Mode of Delivery:**	Regular			
11	**Location of Teaching the Course:**	University Campus			
12	**Prepared by:**				
13	**Date of Approval:**	2023			

II. Course Description:

Course Description: This course is an advanced study of the principles and techniques used to analyze biological molecules. Topics covered include: Chromatography, Spectroscopy, Mass spectrometry, Immunoassays, and Biosensors.

III. Alignment Course Intended Learning Outcomes with program outcomes

III. Course Intended Learning Outcomes (CILOs)		Referenced PILOs
A. Knowledge and Understanding: *Upon successful completion of the course, students will be able to:*		
a1	**Understanding** of instruments techniques and principles of chromatography, electrophoresis, mass spectrometry, nuclear magnetic resonance spectroscopy, biosensors, and imaging techniques	A1
B. Intellectual Skills: *Upon successful completion of the course, students will be able to:*		
b1	Interpret analytical data	B1
C. Professional and Practical Skills: *Upon successful completion of the course, students will be able to:*		
c1	**Perform** a wide variety of biochemical an molecular techniques	C1
D. Transferable Skills: *Upon successful completion of the course, students will be able to:*		
d1	**Communicate** scientific concepts and findings effectively in written and oral formats	D1

Prepared by:	Reviewed by:	Head of the Department:	Vice Dean for Quality affairs	Dean of College:
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IV. Alignment Course Intended Learning Outcomes with Teaching Strategies and Assessment methods:

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1	**Understanding** of instruments techniques and principles of chromatography, electrophoresis, mass spectrometry, nuclear magnetic resonance spectroscopy, biosensors, and imaging techniques	Lectures	exam

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1	**Interpret** analytical data	Lectures Laboratory practical	Exam

C Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1	**Perform** a wide variety of biochemical an molecular techniques	Lectures Laboratory practical	Exam Lectures Laboratory practical

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

	Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1	Communicate scientific concepts and findings effectively in written and oral formats		

NO.	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes (CILOs)
1	General principles of biochemical investigations	Overview of Biochemical Investigations, Introduction to Biochemical Analyzing Instruments	2	4	a1,b1,c1,d1
2	Centrifugation techniquse	Basic principles of sedimentation, Density gradient centrifugation, Preparative centrifugation (differential centrifugation, Density gradient centrifugation), Analytical subcellular fractions, Some application of analytical ultracentrifugation.	2	4	a1,b1,c1,d1
3	Enzyme techniques	Enzyme classification, units, protein estimation, purification, enzyme kinetics, enzyme assays, spectroscopic, luminescence, radioisotope, immobilized enzymes.	3	6	a1,b1,c1,d1
4	Immunochemical techniques	Antibody structure, types, definitions, Ab`s production, polyclonal, monoclonal, qualitative and quantitative analysis of antigens, immunodiffusion one & two dimensional, immunoelectrophoresis, radioimmunoassay, ELISA, fluorescence IA, particle counting IA.	4	8	a1,b1,c1,d1
5	Chromatographic Techniques	General principle, Column chromatograph, TLC, Paper chromatography, Adsorption chromatography, Partition chromatography, GLC, Ion-exchange chromatography, Exclusion chromatography, Affinity chromatography, HPLC.	3	6	a1,b1,c1,d1
7	Final Exam		1	2	a1,b1,c1,d1
Number of Weeks /and Units Per Semester			15	30	

V. Teaching Strategies of the Course:	
1-	Lectures
2-	Seminars

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Dr\ Nawal Al- Henhena	Dr. Nabil Alowiri	DrNawal Al- Henhena	Dr\Gamil Taher Abdul Mughni	- Associate Prof. Dr. Ebtesam Al-Zabedi

VI. Assessment Methods of the Course:

No	Assignment
1	Written Exams (Essays) and Quizzes
3	Oral Exams
5	Student presentation

VII. Assignments:

No.	Assignments	Week Due	Mark	Proportion of Final Assessment	Aligned CILOs (symbols)
2	Activity	Throughout the semester	20	20%	a1,b1,c1,d1
5	Final Exam		80	80%	a1,b1,c1,d1
Total			100		

Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology-Robert H. Carman. 2nd Edn. CMAI, New Delhi

2- Essential References.

- Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. Bhalani Publication.
- Handbook of Biochemistry by M. A. Siddique 8th Edn. Vijay Bhagat Scientific Book

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1. Ebook link- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalbiochemistry.pdf
2. Ebook link- https://books.google.co.in/books?id=Je_pJfb2r0cC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=

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Ebook link- https://books.google.co.in/books?id=2FkXAwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

XI. *Course Policies:*	
1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
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7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration

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