

# STUDY GUIDE

## Biochemistry-1

1211211



### Course coordination

Female section **Dr. Naglaa Mokhtar** ([Naglaa.Ibrahim@nbu.edu.sa](mailto:Naglaa.Ibrahim@nbu.edu.sa))

Male section **Dr. Abdelnaser Badway** ([abdelnaser.ali@nbu.edu.sa](mailto:abdelnaser.ali@nbu.edu.sa))

برنامج كلية الطب  
Program MBBS

جامعة الحدود الشمالية  
NORTHERN BORDER UNIVERSITY  
كلية الطب

**الرسالة :**  
إعداد أطباء يُميّزون بالكفاءة المعرفية السريرية والبحثية لتقديم الخدمات الصحية وتعزيز صحة المجتمع محلياً وإقليمياً

**الأهداف:**

- ▶ تخريج الأطباء المتميزين بالمهارات المهنية والبحثية.
- ▶ تعزيز ممارسات القيادة والتواصل الفعال.
- ▶ إكساب الطلاب مهارات العمل الجماعي والتعلم الذاتي المستمر.
- ▶ تحسين جودة الخدمات الصحية والشراكة المجتمعية محلياً.
- ▶ تشجيع البحث العلمي الطبي.

**Mission:**  
Preparing physicians characterized by cognitive, clinical and research competencies to provide health services that enhance community health locally and regionally.

**Goals:**

- ▶ Graduating distinguished physicians with professionalism and research skills.
- ▶ Enhance the practice of leadership and effective communication.
- ▶ Teach students teamwork skills and continuous self-learning.
- ▶ Improving the quality of health services and community partnership regionally.
- ▶ Encouraging scientific medical researches.

From the North to the Nation

من الشمال .. إلى الوطن

### Course Identification

1. Credit hours	5
2. Level/year at which this course is offered	2nd year – 5 <sup>th</sup> semester
3. Pre-requisites for this course	Pass in 1 <sup>st</sup> year

### Course contributors names

- 1- Prof. Manal Said Fawzy
- 2- Dr. Abdelnaser Badway
- 3- Dr. Naglaa Mokhtar

### Actual Learning Hours (Copy and paste the table from courses specification)

No	Activity	Learning Hours
<b>Contact Hours</b>		
1	Lecture	63
2	Laboratory/Studio	9
3	Tutorial	-
4	Others (specify)	-
	<b>Total</b>	<b>72</b>

### Course Objectives (Copy and paste the table from courses specification)

#### 1. Course Description

The course focuses on the structure and biological functions of carbohydrates, proteins, nucleotides, vitamins, enzymes, isozymes, and cell membranes. The course discusses the regulation and inhibition of enzyme activities and diseases produced by vitamin deficiencies. The course illustrates the structure and function of nucleic acids and different steps of DNA replication and repair, transcription, genetic code, mutation, protein biosynthesis, regulation of gene expression, and recombinant DNA technologies. Finally, the course describes the meaning of bioenergetics, oxidative phosphorylation, electron transport chain and its inhibitors, and mechanism of action of uncouplers.

#### 2. Course Main Objectives

- Recognize the different biochemical components of human bodies e.g. carbohydrates, proteins, lipids, enzymes, coenzymes, vitamins, nucleic acids, minerals, cell membrane, and electron transport chain.
- Summarize the variable molecular bioengineering processes e.g., DNA replication and repair, transcription, translation, mutation, and recombinant DNA technologies.
- Analyze the component of unknown organic solutions, carbohydrates, proteins, lipids, urea, and uric acid.
- Appraise the energy released from different biochemical reactions inside the body.
- Demonstrate the different biochemical techniques e.g., Colorimeter, spectrophotometer, HPLC, electrophoresis, DNA extraction, and PCR.

### Course Learning Outcomes (Copy and paste the table from courses specification)

CLOs		Aligned PLOs
<b>1</b>	<b>Knowledge and Understanding</b>	
<b>1.1</b>	Describe classifications, structure, properties, synthesis, and biological functions of carbohydrates, lipids, and proteins and define their assembly in connective tissue and cell membrane	<b>K1</b>
<b>1.2</b>	Recognize the mechanism of action and functions of vitamins, minerals, and enzymes and their regulatory roles in metabolism, growth, and development	<b>K1</b>
<b>1.3</b>	State the steps of DNA replication, damage and repair, RNA transcription, and protein synthesis and their roles in hereditary diseases	<b>K1</b>

CLOs		Aligned PLOs
<b>2</b>	<b>Skills:</b>	
2.1	Apply the common laboratory techniques used to study carbohydrates, lipids, proteins, minerals, vitamins, and genetic material and interpret their data.	S2
2.2	Apply the core-writing skills to express his knowledge and ideas	S6
<b>3</b>	<b>Values:</b>	
3.1	Employ the skill of self-learning through updated medical information from different approved sources	V1

### Course Content (Copy and paste the table from courses specification)

No	List of Topics	Contact Hours
1	Classification of carbohydrates & Structure of monosaccharaides	2
2	Isomerism- Derived sugars & Disaccharides	2
3	Polysaccharides	2
4	Amino acids Classification, Properties	2
5	Structure of amino acids	2
6	Higher orders of proteins and folding process	2
7	Globular proteins: HB & myoglobin	2
8	Fibrous proteins	2
9	Simple lipids	2
10	Phospholipids- Glycolipids	2
11	Lipoproteins – Steroids	2
12	Practical: Physical chemistry	1
13	Practical: Physical chemistry	1

14	Practical: Physical chemistry	1
15	Chemical nature of the enzymes & classification Mechanism of action	2
16	Factors affecting rate of enzyme action	2
17	Regulation of enzyme activities- Enzyme inhibition	2
18	Enzymes in Clinical Diagnosis- isozymes	1
19	Nucleotides	1
20	DNA structure & DNA organization.	2
21	DNA replication	2
22	DNA damage & repair	1
23	RNA	1
24	Transcription	2
25	Genetic code & mutation	2
26	Protein synthesis- Posttranslational modification	2
27	Regulation of gene expression	2
28	DNA recombinant technology & applications	2
29	Chemical structure of cell membrane	1
30	Vitamin C - vitamin B1 & B2	1
31	B3 & B5,	2
32	B6, B7, B9, B10	2
33	Practical: HPLC	1

34	Practical: isozymes	1
35	Vitamin A, D	2
36	Vitamin E, K	2
37	Practical: DNA extraction	1
38	Practical: electrophoresis	1
39	Practical: PCR	1
40	Major minerals: Na <sup>+</sup> , K <sup>+</sup> , Cl <sup>-</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup> , Ph, S....etc.	2
41	Trace elements: Iron, Copper, Zinc ....etc	1
42	Practical: calcium estimation	1
43	Redox chain	1
44	free energy	1
45	Oxidative phosphorylation	2
<b>Total</b>		72

**Teaching strategies and Assessment Methods for Students (Copy and paste the table from courses specification)**

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and Understanding</b>		
<b>1.1</b>	Describe classifications, structure, properties, synthesis, and biological functions of carbohydrates, lipids, and proteins and define their assembly in connective tissue and cell membrane	Direct instructional (Lectures)	Written exams (MCQs & SAQs).
<b>1.2</b>	Recognize the mechanism of action and functions of vitamins, minerals, and enzymes and their regulatory roles in metabolism, growth, and development	Direct instructional (Lectures)	Written exams (MCQs & SAQs).
<b>1.3</b>	State the steps of DNA replication, damage and repair, RNA transcription, and protein synthesis and their roles in hereditary diseases	Direct instructional (Lectures)	Written exams (MCQs & SAQs).
<b>2.0</b>	<b>Skills</b>		
<b>2.1</b>	Apply the common laboratory techniques which are used to study carbohydrates, lipids, proteins, minerals, vitamins, and genetic material and interpret their data	Direct instructional (Lab demonstration)	OSPE
<b>2.2</b>	Apply the core-writing skills to express his knowledge and ideas	Homework-assignment	Assignment rubric
<b>3.0</b>	<b>Values</b>		
<b>3.1</b>	Employ the skill of self-learning through updated medical information from different approved sources	Homework-assignment	Assignment rubric



### Assessment Tasks for Students (Copy and paste the table from courses specification)

#	Assessment task*	Week Due	Percentage of Total Assessment Score
2	Midterm	6 <sup>th</sup>	25%
3	Assignment	10 <sup>th</sup>	15%
4	OSPE	End of semester	20%
5	Final exam	End of semester	40%

### Course blueprint (% of total summative marks in blueprint is to be given in the range)

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Classification of carbohydrates & Structure of monosaccharides	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Isomerism- Derived sugars & Disaccharides	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Polysaccharides	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Amino acids Classification, Properties	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Structure of amino acids	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Higher orders of proteins and folding process	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Globular proteins: HB & myoglobin	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Fibrous proteins	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Simple lipids	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Phospholipids- Glycolipids	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Lipoproteins – Steroids	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Chemical nature of the enzymes & classification & Mechanism of action	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Factors affecting rate of enzyme action	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Regulation of enzyme activities- Enzyme inhibition	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Enzymes in Clinical Diagnosis- isozymes	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
Nucleotides	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
DNA structure & DNA organization.	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
DNA replication	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
DNA damage & repair	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
RNA	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
Transcription	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Genetic code & mutation	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Protein synthesis- Posttranslational modification	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Regulation of gene expression	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
DNA recombinant technology & applications	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Chemical structure of cell membrane	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
Vitamin C - vitamin B1 & B2	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
B3 & B5,	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
B6, B7, B9, B10	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Vitamin A, D	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Vitamin E, K	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Major minerals: Na <sup>+</sup> , K <sup>+</sup> , Cl <sup>-</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup> , Ph, S....etc.	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Trace elements: Iron, Copper, Zinc ....etc	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
Redox chain	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
free energy	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	1.4%	1-2
Oxidative phosphorylation	Direct instructional (Lectures)	Written exams (MCQs & SAQs)	K1	-	-	-	-	S6	V1	-	-	2.8%	2-3
Practical: physical chemistry	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: physical chemistry	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: physical chemistry	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: HPLC	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: isozymes	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3

Topics	Teaching strategies	Assessment methods	Knowledge & Understanding			Skills			Values			% of total contact hours	% of total summative marks
			K1	K2	...	S1	S2	S6	V1	V	...		
Practical: DNA extraction	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: electrophoresis	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: PCR	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3
Practical: calcium estimation	Lab. based	OSPE	-	-	-	-	S2	-	-	-	-	1.4%	2-3

### Learning Resources (Copy and paste the table from courses specification)

<b>Required Textbooks</b>	Lippincott's Illustrated Reviews of Biochemistry, 7 <sup>th</sup> edition (2017): Richard A. Harvey, & Denise R. Ferrier. Lippincott's Williams & Wilkins.
<b>Essential References Materials</b>	<ol style="list-style-type: none"> <li>Harpers Illustrated Biochemistry: 31<sup>st</sup> Edition (2018): Victor W. Rodwell, David Bender. The McGraw Hill Education.</li> <li>Textbook-of-Biochemistry-For-Medical-Students-6th-Edition (2011). DM-Vasudevan, Sreekumari S, Kannan Vaidyanathan</li> </ol>
<b>Electronic Materials</b>	<a href="https://www.acb.org.uk/our-resources/biochemistry.html">https://www.acb.org.uk/our-resources/biochemistry.html</a> <a href="https://www.asbmb.org/education/online-teaching/online-lab-work">https://www.asbmb.org/education/online-teaching/online-lab-work</a> <a href="https://biochem.oregonstate.edu/content/biochemistry-free-and-easy">https://biochem.oregonstate.edu/content/biochemistry-free-and-easy</a> - other websites updated each year
<b>Other Learning Materials</b>	- Department lectures power points.

### Related check lists

PBL

Assignment

Clinical skills checklist

---

Presentation checklist ✓

Project checklist

Workshop checklist

(Checklist must be aligned with the learning outcomes)

### Course quality evaluation

After the end of the course, please give your **FEEDBACK** through the following link:

<https://docs.google.com/forms/d/1IKf4va0FSQsr-7MCXVpdaTzni9W7WYZ6WPVzVO-Z65A/edit>

