



Course Specification

— (Bachelor)

Course Title: **Biochemistry**

Course Code: **CHM 1271**

Program: **Bachelor of Science in Chemistry**

Department: **Chemistry**

College: **Science**

Institution: **Imam Mohammed Ibn Saud Islamic University**

Version: **2024 V 1**

Last Revision Date: **13 October 2024**

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A. General information about the course:

-1. Course Identification

1. Credit hours: 3 (2, 0, 3)

3 (2 Lectures, 3 Lab, 0 Tutorials)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: Level 4/ Second year

4. Course general Description:

This course is an introduction to the basic principles of biochemistry, the chemistry of living organisms, providing the necessary knowledge and background that a chemist should have about all chemical reactions occur in a living cell. The course introduces the student to the biomolecules (including protein, carbohydrate, lipid, DNA and RNA) function, structure, synthesis, and their metabolism.

5. Pre-requirements for this course (if any):

CHM 1221 Organic Chemistry (1)

Bio 1101 General Biology

6. Co-requisites for this course (if any):

None

7. Course Main Objective(s):

The students should be able to:

- Know basic cellular structure.
- Know the main role of water, PH, buffers in biological systems.
- Recognize the biomolecules and the difference between them with knowing their role.
- Learn the properties, structures, and functions of the biomolecules.
- Study in details the chemistry of macromolecules (protein, carbohydrate, lipid, and DNA and RNA), and the micromolecules (amino acids, fatty acids, mono- and di-saccharide, and nucleic acids, which are the building blocks of the macromolecules.
- Explaining all pathways that occur in a living organism and the metabolism (anabolism and catabolism).
- Be familiar with basic biochemistry techniques and experiments.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	0	0
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom 	0	0





No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	45
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	To define the fundamentals of biochemistry	K1, K3	<ul style="list-style-type: none"> • Five hours are weekly, containing lectures and laboratory activities. • A Private study including home exam. . 	<ul style="list-style-type: none"> • Quizzes, • Lab reports, class • Questions • Exams (midterms and finals)
1.2	To State biochemistry terminology	K1	<ul style="list-style-type: none"> • Group discussion • Laboratory activities 	<ul style="list-style-type: none"> • Quizzes, • Lab reports, • Class Questioning, • Exams (midterms and finals)
1.3	To outline the biological molecules and the differences between them	K1, K3	<ul style="list-style-type: none"> • Five hours are weekly for laboratory activities 	<ul style="list-style-type: none"> • Quizzes, • Lab reports, • Homework • Exams (midterms and finals)





Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.4	To recognize the chemistry inside living organisms	K1, K3	<ul style="list-style-type: none"> Think, talk, and review biological molecules and its effect Lectures Group discussion laboratory activities 	<ul style="list-style-type: none"> Quizzes, Lab reports, Class questioning, Exams (midterms and finals)
2.0	Skills			
2.1	To distinguish the differences of biomolecules	S1	Introduce some examples of biomolecules in plant cells and animal cells	<ul style="list-style-type: none"> Quizzes, Lab reports, Class questions Exams (midterms and finals)
2.2	To explain and apply the most important techniques in a biochemistry laboratory	S3, S4	<ul style="list-style-type: none"> Lectures Oral Discussions. Brainstorming Exercises 	<ul style="list-style-type: none"> Examination Laboratory report Oral tests
2.3	To relate the biochemistry field with other chemistry fields (e.g., Organic and inorganic chemistry)		<ul style="list-style-type: none"> Lectures Oral Discussions. Brainstorming Exercises 	<ul style="list-style-type: none"> Oral tests Lab performance, reports, Sheets Marks Assignments and homework marks
3.0	Values, autonomy, and responsibility			
3.1	To appraise a moral value toward acquiring knowledge and dealing with others	V1, V2	<ul style="list-style-type: none"> Group discussion, assignments, and homework Lab-reports Virtual labs and demonstrations 	<ul style="list-style-type: none"> Oral tests, lab performance, Reports, Sheets Marks Assignments Homework marks
3.2	To show self-esteem, self-discipline, confidence, and other skills	V1, V2	<ul style="list-style-type: none"> Brainstorms Exercises Group Discussion 	<ul style="list-style-type: none"> Oral Discussion. Group Discussion and Assignments



C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to biochemistry: what is biochemistry? procaryotic and eucaryotic cells, cell structures, water, PH, buffer, ionic equilibrium	5
2.	Protein: amino acids, structure of protein, globular and fibrous protein, enzymes	5
3	Bioenergetics: role of ATP, biologic oxidation, respiratory chain and oxidative phosphorylation	5
4	Carbohydrates and the metabolism of carbohydrates: introduction to carbohydrates, glycolysis, TCA cycle, gluconeogenesis, glycogen metabolism, pentose phosphate pathway, glycosaminoglycans and glycoproteins	5
5	Lipid and the metabolism of lipid: introduction to lipid, fatty acid and triacylglycerol metabolism, complex lipid metabolism, lipid transport and storage, cholesterol and steroid metabolism	5
6	Nucleic acid: nucleotides, DNA structure, replication, and organization, RNA structure, synthesis, and translation, protein synthesis and genetic code	5
Total		30
No	List of Experiments	Contact hours
1	Biochemistry laboratory instructions: Lab guideline, safety, equipment, glassware, chemicals, how to write a scientific report	3
2	Buffer solutions: definition, preparing buffer solutions, calculating PH, buffer capacity	3
3	Amino acids: Solubility of amino acids, Ninhydrin test, Xanthoprotein test, millon test, Sakaguchi test, sulfur test	6
4	Protein: The Lowry and Biuret assays	3
5	Protein: The Bradford and BCA assays	3
6	Protein: affecting of salt on protein, precipitation by acids, precipitation by high temperature, precipitation by salt and heavy metals	3
7	Protein: Enzyme assay	3



8	Carbohydrates: Molisch test, benedict's test, barfoed's test, bial's test, seliwanoff's test, hydrolysis of sucrose test, Iodine/potassium iodide test,	3
9	Carbohydrates: hydrolysis of starch, glucose concentration estimation by enzymatic test, estimation of total sugar	3
10	Lipid: Lipid solubility test, saponification test, testing the separation of soap from solution by salt, test formation insoluble fatty acids salt	3
11	Lipid: Copper acetate test, Burchard test, Acrolein test, unsaturated fatty acid test	3
12	DNA: DNA extraction	3
13	DNA: DNA characterization	3
14	Revision	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	6th/ 7th week	10 %
2.	Midterm 2	11th/ 12th week	10 %
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4.	Laboratory	All the semester	30 %
5.	Final Exam	16-17thweek	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Lippincott's Illustrated Reviews Biochemistry, 7th edition, by Pamela C. Champe, Richard A. Harvey, and Denise R. Ferrier.
Supportive References	<ol style="list-style-type: none"> Lehninger principles of Biochemistry, 4th edition, by David L. Nelson and Michael M. Cox. Harper's Illustrated Biochemistry, 31st edition, international edition, by Victor W. Roadwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, and P. Anthony Weil.
Electronic Materials	<ol style="list-style-type: none"> Oxford journal of Biochemistry. http://jb.oxfordjournals.org/ American journal of Biocemistry.
Other Learning Materials	None



2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<ul style="list-style-type: none"> Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. In each laboratory, a list of safety and precautions are provided. In each lab has proper ventilation, and well equipped with instruments. In each lab, containers for solid waste, liquid waste, and crushed glasses. Each lab has a small pharmacy for first aid in case of an accident In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions according to Merck Catalogue are hanging in the labs
Technology equipment (projector, smart board, software)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	<ul style="list-style-type: none"> Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders) Appropriate fine chemicals and solvents (distilled Water ammonium nitrate) Analytical balance (3 digits), Set gas laws with the glass jacket Data acquisition set for gas laws with glass jacket, PC, Windows® 95 or higher, calorimeter, thermometer, Filter papers , clamps, stands

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Course Responsible Peer Reviewer	Direct: Questionnaire. Direct: Course e-Portfolio. Indirect: Second examiner checklist-Course report. Direct: Questionnaire. Indirect: External assessor report.
Effectiveness of Students assessment	Program Leaders	Direct: Course e-Portfolio. Indirect: Course report.
Quality of learning resources	Students	Indirect: Second examiner checklist-Course report.



Assessment Areas/Issues	Assessor	Assessment Methods
	Faculty (Academic Advisory)	Direct: course Entrance/Exit. Indirect: Observations - Accreditation review. Direct: Course e-Portfolio. Indirect: Course evaluation survey- Observations- Syllabus review- Accreditation review.
	Program Leaders	
The extent to which CLOs have been achieved	Course Responsible	Direct: Exams - Course e-Portfolio.
Lab Performance	Students	Direct: Lab reports, Final Lab exam, Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	COUNCIL OF DEPARTMENT OF CHEMISTRY
REFERENCE NO.	7 (NO. 2/3)
DATE	29/3/1446 - 2/10/2024

