CHEM2071: BIOLOGICAL CHEMISTRY

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Biological Chemistry

Subject Code
CHEM - Chemistry
Course Number
2071

Academic Unit
Chemistry (CHEM)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
4

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
CHEM1200/BCH1200 Discovery in Biology (for normative 4-year students) or A Level Biology (for advance standing I students)

Equivalent Courses
BCH2071 Biological Chemistry

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide students with fundamental chemistry knowledge that is relevant and applicable to biological systems. Through the course, students will gain an understanding of the chemical structures and the functions of various biomolecules found in living systems. Students will learn the basic classification systems, functional groups, principles of nomenclature, aromaticity and chirality of organic compounds. Students will also be introduced to various fundamental and important biological molecules, including nucleic acids, proteins, carbohydrates and lipids. Through different learning activities such as lectures, tutorials and lab sessions, students will gain comprehensive and in-depth understanding of the functions and the biochemical roles of important biomolecules in life and their relationships with human health.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the basic concepts of pH, buffer, chemical bonding, polar/nonpolar compounds, resonance and molecular interactions in biological systems.	10	x	x	
2	Describe functional groups, basic reaction types, and different reaction mechanisms.	25	x	x	
3	Explain the structures and functions of important biomolecules (DNAs, amino acids, lipids, proteins, enzymes and carbohydrates) and their fundamental reactions in biological processes.	40	x	x	
4	Perform experiments to study the chemical and biochemical properties of different biomolecules.	15	x	x	x
5	Explain the relationships between biomolecules and human health.	10	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will learn pH, buffer, chemical bonding, and classification of organic compounds.	1	6 hrs
2	Lectures	Students will learn functional groups, different types of chemical reactions and reaction mechanism.	2	12 hrs

3	Lectures	Students will learn the structures and the functions of different biomolecules, including amino acids, peptides, proteins, lipids, DNAs and carbohydrates.	3	18 hrs
4	Tutorials	Students will receive tutorials to understand relevant topics, including pH, chemical reactions, peptide synthesis, protein structures, enzyme catalysis, DNA structure, carbohydrate conformation and others.	1, 2, 3	12 hrs
5	Practicals	Students will participate in practical sessions designed to help them better understand the lecture materials and train their experimental skills.	4	20 hrs
6	Group projects and oral presentations	In small groups, students will carry out group projects and deliver oral presentations to share their understanding of the relationship between biomolecules and human health. They will be encouraged to think creatively and critically.	5	3 hrs

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	2	5	
2	Quiz	1, 3	10	
3	Lab reports	4	15	
4	Project and oral presentation	5	10	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

Additional Information for ATs

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM: "A minimum of 40% in both coursework and examination components."

Assessment Rubrics (AR)

Assessment Task
Assignments

Criterion
Demonstration of understanding the principles and practice of the selected topics of biological chemistry.

Excellent (A+, A, A-)
Able to demonstrate excellent understanding of the principles and practice of the selected topics of biological chemistry.

Good (B+, B, B-)
Able to describe and explain the principles of the selected topics of biological chemistry.

Fair (C+, C, C-)
Able to describe and explain some key principles of the selected topics of biological chemistry.

Marginal (D)
Able to briefly describe isolated principles of the selected topics of biological chemistry.

Failure (F)
Fail to accurately describe and explain relevant principles of any topics of biological chemistry.

Assessment Task
Quiz

Criterion
Demonstration of understanding the principles and practice of various topics of biological chemistry.

Excellent (A+, A, A-)
Able to demonstrate excellent understanding of the principles and practice of various topics of biological chemistry.

Good (B+, B, B-)
Able to describe and explain the principles of various topics of biological chemistry.

Fair (C+, C, C-)
Able to describe and explain some key principles of selected topics of biological chemistry.

Marginal (D)
Able to briefly describe isolated principles of selected topics of biological chemistry.

Failure (F)
Fail to accurately describe and explain relevant principles of any topics of biological chemistry.

Assessment Task
Lab reports (CHEM2071 only)

Criterion
Demonstration of understanding the principles and practice of the selected topics of biological chemistry experiments.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics in biological chemistry experiments.

Good (B+, B, B-)

Able to describe and explain the principles of various topics in biological chemistry experiments

Fair (C+, C, C-)

Able to describe and explain some key principles of selected topics in biological chemistry experiments

Marginal (D)

Able to briefly describe isolated principles of selected topics in biological chemistry experiments

Failure (F)

Fail to accurately describe and explain relevant principles of any topics in biological chemistry experiments

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Assessment Task

Project and oral presentation

Criterion

Demonstration of understanding the principles and practice of the selected topics of biological chemistry, and the ability to present those principles and practice in concise, orderly and professional manners.

Excellent (A+, A, A-)

Able to deliver fluent, well organized and well prepared presentations to demonstrate excellent understanding of the principles and practice of the selected topics of biological chemistry.

Good (B+, B, B-)

Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the principles of the selected topics of biological chemistry

Fair (C+, C, C-)

Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles of the selected topics of biological chemistry.

Marginal (D)

Able to deliver comprehensible presentations to briefly describe isolated principles of the selected topics of biological chemistry.

Failure (F)

Fail to present relevant principles of any topics of biological chemistry in coherent and comprehensible manners.

Assessment Task

Examination

Criterion

Demonstration of understanding the principles and practice of various topics of biological chemistry.

Excellent (A+, A, A-)

Able to demonstrate excellent understanding of the principles and practice of various topics of biological chemistry.

Good (B+, B, B-)

Able to describe and explain the principles of various topics of biological chemistry.

Fair (C+, C, C-)
Able to describe and explain some key principles of selected topics of biological chemistry.

Marginal (D)
Able to briefly describe isolated principles of selected topics of biological chemistry.

Failure (F)
Fail to accurately describe and explain relevant principles of any topics of biological chemistry.

Part III Other Information

Keyword Syllabus

- Introduction to biological chemistry
- Buffers and indicators
- Organic nomenclature, functional groups and organic reactions
- Biomolecules (i.e. nucleic acids, proteins, carbohydrates and lipids)
- Enzyme classification, catalytic mechanism and kinetics
- Structure, chemical reactions and biological functions of biomolecules
- Bioenergetics and free energy

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	General, organic, and biological chemistry. Frost, Laura D. author. Deal, Todd S. author. Third edition / Laura Frost, Todd Deal. Upper Saddle River, N.J. : Pearson, 2017
2	General, organic, and biochemistry Denniston, K. J (Katherine J.) 8th ed. New York, NY : McGraw-Hill Companies, c2014