CHEM4045: MEDICINAL CHEMISTRY

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Medicinal Chemistry

Subject Code
CHEM - Chemistry
Course Number
4045

Academic Unit
Chemistry (CHEM)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
CHEM2007/BCH2007 Principles of Organic Chemistry

Equivalent Courses
BCH4045 Medicinal Chemistry

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aims to:

- introduce drug discovery, design and development process;
- explore the interaction of drug target and drug;
- develop knowledge and techniques to identify drug targets including enzymes, receptors, and nucleic acids;
- analyse the improvement of current anticancer and antibacterial drugs;
- critically evaluate the strategy for lead identification and optimizing pharmacokinetic properties.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the principles and strategies used for drug design in the drug discovery and development process.	20		x	
2	Discover the principles of receptor-drug binding, enzyme inactivation, and DNA binding interactions of DNA-binding drugs.	20	x		
3	Explain enzymes, receptors, and nucleic acids as drug targets and evaluate current drugs against these targets.	25	x		
4	Outline the importance and the development of anticancer drugs and antibacterial drugs.	20			x
5	Explain modern techniques and strategies in lead identification and optimizing pharmacokinetic properties, including target identification, structure-activity relationships, high-throughput screening, optimizing access to the target, etc.	15		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 about the principles behind a range of drug discovery techniques in lectures, with a range of examples drawn from medical and research applications.	1	

2	Group activities and assignments	Students will work in small groups to present the principles of enzyme, enzyme inactivation, receptor, DNA and different DNA–binding drugs based on guided information search. Assignment will be arranged for students to demonstrate information searching ability.	2	
3	Lectures	Students will learn about the principles, applications, processes and research methodologies to identify current drugs targets including enzymes, receptors, and nucleic acids.	3	
4	Lectures	Students will learn about the strategies and examples of anticancer drugs and antibacterial drugs.	4	
5	Lectures	Students will learn about the basic concepts and principles of lead identification, structure-activity relationships, and optimizing access to the target, as well as their application in drug discovery and development.	5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment	1, 2, 3, 4, 5	10	
2	Quiz	1, 2, 3, 4, 5	10	
3	Presentation	2	10	

Continuous Assessment (%)

30

Examination (%)

70

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

Assignment

Criterion

Ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Excellent (A+, A, A-)

Excellent ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Good (B+, B, B-)

Good ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Fair (C+, C, C-)

Some ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Marginal (D)

Basic ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Failure (F)

Fail to demonstrate excellent ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug synthesis, and drug-target interactions.

Assessment Task

Quiz

Criterion

Ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Excellent (A+, A, A-)

Excellent ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Good (B+, B, B-)

Good ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Fair (C+, C, C-)

Some ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Marginal (D)

Basic ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Failure (F)

Fail to demonstrate excellent ability to analyze and solve problems relevant to drug structure, drug mechanism, drug design, drug-target interactions, anticancer drugs, and antibiotics.

Assessment Task

Presentation

Criterion

Ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Excellent (A+, A, A-)

Excellent ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Good (B+, B, B-)

Good ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Fair (C+, C, C-)

Some ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Marginal (D)

Basic ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Failure (F)

Fail to demonstrate good ability to present clearly the discovery, production, mechanism, and other properties of a marketed drug.

Assessment Task

Examination

Criterion

Ability to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides, nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Excellent (A+, A, A-)

Excellent ability to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides,nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Good (B+, B, B-)

Good ability to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides, nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Fair (C+, C, C-)

Some ability to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides, nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Marginal (D)

Basic ability to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides, nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Failure (F)

Fail to analyze and solve problems relevant to intermolecular bonding, nucleotides and nucleosides, nucleic acids as drug targets, antibiotics, anticancer drugs, drug design process and methods to establish a lead compound, structure-activity relationships, and lead identification.

Part III Other Information

Keyword Syllabus

- drug discovery, design and development process: drug screening, lead compound, ADME, metabolism, clinical trials
- drug target and drug: enzyme, DNA, enzyme inactivation, competitive enzyme inhibitor, irreversible enzyme inhibitor, DNA-interactive drug, DNA intercalator, DNA alkylator, DNA strand breaker, drug combination, drug resistance, drug interaction
- target identification: active site, affinity, efficacy, potency, in vivo and in vitro tests
- anticancer and antibacterial drugs: platinum-based anticancer drugs, taxol, methotrexate, Vinca Alkaliods
- lead identification, structure-activity relationships, pharmacokinetics, and pharmacodynamics

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman (Academic Press)
2	An Introduction to Medicinal Chemistry, G. L. Patrick (Oxford, 3rd edition)
3	Online Resources: http://www.zhulab.com/styled-2/index.html