

Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year	AY2026-2027
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Liu Xuewei
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Course Title	MEDICINAL CHEMISTRY
Course Code	CM5081
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	(BS1003 and BS1005) or CM1002 or CY1101 or (BS1013 and BS1005) by permission
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

Medicinal chemistry is a chemistry-based discipline, involving aspects of biological, medical and pharmaceutical sciences. The primary goals for this course are for everyone to gain: 1) an understanding of drug behavior in the body; 2) an appreciation of drug development, from lead optimization, to patents and drug registration and to drugstore shelf; and 3) an awareness of drug toxicity (side effects), from acute responses to long-term effects. Having successfully completed this course, you will not only develop the necessary knowledge and skills for a career that involves medicinal chemistry for research and pharmaceutical application in industry, but also a working knowledge of how and where to find information on any drug you may encounter as you continue your lives, even if your own career choice does not involve health care.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Essential concepts of pharmacodynamics (PD) of drugs: a) Describe common drug targets and mode of action; b) Identify and describe the underlying mechanism of therapeutic effects and possible side effects; c) Provide a holistic account of what the drug does to our body.
ILO 2	Essential concepts of pharmacokinetics (PK) of drugs: a) Describe the absorption, distribution, metabolism and excretion (ADME) of drugs; b) Identify and explain the role of medicinal chemistry in improving these parameters; c) Provide a holistic account of what our body does to the drug.
ILO 3	Special case studies: a) Investigate current hot topics in drug discovery.
ILO 4	Drug discovery, design and development: a) describe the overall process of drug discovery and development, and the concepts of lead optimizations and structural activity relationships in medicinal chemistry, and b) identify the current challenges and opportunities in medicinal chemistry.
ILO 5	Getting the drug to the market: a) identify the key timelines of a utility patent, b) relate its importance to the drug discovery cycle and c) describe how new drugs are registered.
ILO 6	Case studies: a) discuss examples of drug families (antibacterial, anticancer, antiviral and other specific types) to demonstrate an understanding of concepts such as pharmacodynamics, pharmacokinetics, lead optimization, medicinal chemistry and drug discovery and development process.

Course Content

1. Course overview
2. Biomolecules as drug targets
3. Proteins & enzymes as drug targets
4. Drug receptors as drug targets
5. Genetic components as targets
6. ADME: absorption, distribution, metabolism & excretion
7. Nanomedicine
8. Drug discovery and development; medicinal chemistry
9. Patents and new drug registration
10. Specific drug families (topics to be decided, based on students' interest and guest lecturers' availability)

Reading and References (if applicable)

1. Recommended textbook:

An Introduction to Medicinal Chemistry

6th Edition, G.L. Patrick, Oxford University Press, 2017. ISBN: 9780198749691

2. Optional reference 1:

The Organic Chemistry of Drug Design and Drug Action

3rd Edition, R. B. Silverman, Elsevier, 12 Jan 2015. ISBN: 9780123959034

3. Optional reference 2:

Foye's Principles of Medicinal Chemistry

8th Edition; V. F. Roche, S. W. Zito, T. L. Lemke and D. A. Williams, Lippincott Williams & Wilkins: Philadelphia, 2019. ISBN: 9781496385024

4. Optional reference 3:

Medicinal Chemistry: An Introduction

2nd edition; G. Thomas; John Wiley & Sons Inc, 2008. ISBN: 9780470025970

5. Optional reference 4:

Molecules and Medicine

E. J. Corey, B. Czakó and L. Kürti. John Wiley & Sons Inc, 2012. ISBN: 9780470260968

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Course overview	1,2,3	Patrick Chapter 1	In-person	
2	Biomolecules as drug targets; Proteins & enzymes as drug targets	1	Patrick Chapter 2, 3, 7	In-person	
3	Drug receptors as drug targets	1	Patrick Chapter 4, 5, 8	In-person	
4	Drug receptors as drug targets	1	Patrick Chapter 4, 5, 8	In-person	
5	Genetic components as targets	1	Patrick Chapter 6, 9	In-person	
6	ADME: absorption, distribution, metabolism & excretion	2	Patrick Chapter 10	In-person	
7	ADME: absorption, distribution, metabolism & excretion	2	Patrick Chapter 10	In-person	
8	ADME: absorption, distribution, metabolism & excretion	2	Patrick Chapter 10	In-person	
9	Nanomedicine, Course review	3, 1-3	Assigned reference paper	In-person	
10	Drug discovery process and medicinal chemistry	4	Patrick Chapter 12-15	In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
11	Medicinal chemistry and patents	4,5	Patrick Chapter 12-15	In-person	
12	Case studies	6	Assigned reference paper	In-person	
13	Case studies, course review	6, 4-6	Assigned reference paper	In-person	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	<p>Present the key ideas and important steps used to solve different types of problems.</p> <p>Case studies will be delivered by guest lecturers to provide industrial relevance and impact to students.</p>

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Others(CA 1)	1, 3, 6	Competence, written communication	45	Could be MCQ, Short Answer Questions, Report or Presentation, which will be decided by the instructor at the start of the course	Individual	Analytic	Extended Abstract
2	Continuous Assessment (CA): Others(CA 2)	2, 3, 6	Competence, written communication	35	Could be MCQ, Short Answer Questions, Report or Presentation, which will be decided by the instructor at the start of the course	Individual	Analytic	Extended Abstract
3	Continuous Assessment (CA): Others(CA 3)	4, 5, 6	Competence, written communication	20	Could be MCQ, Short Answer Questions, Report or Presentation, which will be decided by the instructor at the start of the course	Individual	Analytic	Extended Abstract

Description of Assessment Components (if applicable)

CM5081 employs three Continuous Assessments designed to evaluate individual performance across different learning outcomes. Continuous Assessment 1 (45%) tests competence and written communication through problem-solving and application-based questions. Continuous Assessment 2 (35%) emphasizes analytical reasoning and interpretation of medicinal chemistry principles. Continuous Assessment 3 (20%) focuses on creativity and integration of knowledge in advanced contexts. All assessments are individually completed and graded using a point-based marking system rather than rubrics, ensuring objective evaluation of students'

conceptual understanding, problem-solving ability, and capacity to apply chemical knowledge to real-world pharmaceutical design and analysis.

Formative Feedback

You will be given feedback in the following ways:

1. Engaging with example problems discussed during lectures.
2. Participating in live polling questions conducted in class.
3. Reading and contributing to discussions on the course discussion board.
4. Reviewing the instructor's comments provided after the grading of midterms, quizzes, and problem sets.
5. Studying the answer keys for all graded assessments.
6. Scheduling a one-to-one consultation with the instructor for individualized feedback.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Collaboration	Intermediate
Communication	Advanced
Curiosity	Intermediate
Critical Thinking	Advanced

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned pre-class readings and activities, attend all lectures classes punctually and take all scheduled assignments and tests by due dates. You are expected to participate in all lectures discussions and activities.

Policy (Absenteeism)

Absence from the midterm without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

Policy (Others, if applicable)

Diversity and Inclusion Policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science and engineering.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences. That honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel your performance in the course is being impacted by your experiences outside of class;
- If something was said in the course (by anyone, including instructor/supervisor) that made you uncomfortable. Please e-mail to your Associate Chair (Students & Continuing Education) at ac-cceb-stud@ntu.edu.sg about how we can help facilitate your learning experience.

As a participant in course discussions you should also strive to honour the diversity of your classmates. You can do this by; using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the course are expected to strictly adhere to the student code of conduct (

<https://www.ntu.edu.sg/life-at-ntu/student-life/student-conduct>). If you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

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