

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

### **Course Overview**

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Zhao Yanli, He Dan
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Course Title	FOUNDATIONS OF CHEMISTRY II
Course Code	CM1002
Academic Units	4
Contact Hours	62
Research Experience Components	Not Applicable

### **Course Requisites (if applicable)**

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	CY1101 and BS1013 and BS1033
Replacement course to	
Remarks (if any)	

## Course Aims

The course covers fundamental concepts and organizing principles of chemistry that provide the foundation for many aspects of chemical science and related fields. It aims to bring Freshmen students in science and engineering to the same level of command of basic chemistry that is essential to progress to advanced courses. The concepts espoused in the course will be illustrated and connected with real world applications whenever relevant. Practical work is at the heart of chemistry. The laboratory component of this course aims to expose you to chosen experiments which will help you gain familiarity with a variety of skills, laboratory techniques and equipment and instill in you the ability to work independently as well as part of a team.

## Course's Intended Learning Outcomes (ILOs)

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

ILO 1	<p>1.Organic chemistry</p> <p>(a) Draw correct molecular structures with stereochemistry and assign stereochemical descriptors to organic molecules.</p> <p>(b) Explain synthesis, properties of organic compounds, such as alkanes, alkenes, benzene and other related aromatic compounds, halides, aldehydes, ketones, as well as carboxylic acids and their derivatives.</p> <p>(c) Identify representative organic reactions of the aforementioned class of compounds, predict, and design some simple molecular transformations involving these compounds.</p>
ILO 2	<p>2. Carbohydrates</p> <p>Determine the types and numbers of stereoisomers in carbohydrates.</p> <p>Recognize the nucleophilic addition to carbonyl compounds to obtain hemiacetal or hemiketal.</p> <p>Explain the interconversion between cyclic alpha and beta-anomers and open-chain carbonyl.</p> <p>Recognize the difference in retaining glycosidase and inverting glycosidases.</p>
ILO 3	<p>3.Proteins</p> <p>Interpret and apply the amino acid properties as building blocks for proteins.</p> <p>Design new macromolecules (e.g. peptides/proteins) via structural biology approaches</p> <p>Translate three-dimensional structures of proteins to aid in designing novel drug molecules</p> <p>Calculate torsion angles for macromolecules</p>
ILO 4	<p>4.Enzyme kinetics</p> <p>Explain the terms <math>V_{max}</math>, <math>K_{cat}</math> and <math>K_i</math> in Michaelis-Menten Kinetics</p> <p>Explain the difference between competitive inhibitor and non-competitive inhibitor</p> <p>Perform Lineweaver-Burk Plot.</p>

ILO 5	<p>5. Lipids</p> <p>Translate the molecular bases of major lipid molecules to the development of diseases based on dysregulated lipid metabolism</p> <p>Recognize and explain the lipid molecule compositions of lipid bilayer membrane in cells.</p>
ILO 6	<p>6.Laboratory</p> <p>(i) Employ in an actual laboratory setting the various analytical and experimental techniques, methods and equipment commonly used in chemical science. Perform basic chemistry lab experiments, analyze, interpret, and present experimental data.</p>

## Course Content

Stereochemistry of  $sp^3$  hybridized carbons. Structure, Synthesis and reactivity of Alkenes, Alkyl halides, Benzene (and related aromatic compounds), Carbonyl compounds and their respective derivatives. Carbohydrates Proteins Enzyme Kinetics Lipids Basic Laboratory Techniques for the Chemistry Laboratory

## Reading and References (if applicable)

Recommended textbook: Organic Chemistry: 9th Ed, John McMurry; ISBN-13: 978-1305080485, ISBN-10: 1305080483 Recommended textbook: Biochemistry, 4th Ed (2013), Mathews / Van Holde / Appling /Anthony-Cahill; ISBN-13: 978-0138004644 Recommended reference textbook: Lehninger Principles of Biochemistry, 5th Ed (2008), Nelson / Cox; ISBN: 9780716771081, W. H. Freeman, 2008

## Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Chemical Bonding and Alkanes	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
2	Stereochemistry at Tetrahedral Centers	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
3	An Overview of Organic Reactions	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
4	Alkenes: Structure and Reactivity	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
5	Alkyl Halides	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
6	Benzene and Aromaticity	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
7	Aldehydes, Ketones and Carboxylic Acids	1	Lecture, pre-recorded lectures, recommended text (see readings and references), other relevant materials and exercises posted on NTULearn		
8	Carbohydrate	2	MVAA Ch 9 Lehninger Ch 7		
9	Proteins	3	MVAA Ch 5, 6 Lehninger Ch 3, 4, 5		

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
10	Proteins	3	MVAA Ch 5, 6 Lehninger Ch 3, 4, 5		
11	Enzyme Kinetics	4	MVAA Ch 5, 6 Lehninger Ch 3, 4, 5		
12	Enzyme Kinetics	4	MVAA Ch 5, 6 Lehninger Ch 3, 4, 5		
13	Lipids	5	MVAA Ch 10 Lehninger Ch 11		

## Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures (39 hours)	The lectures will convey key concepts in organic chemistry and biochemistry/chemical biology thus providing critical information and background on how the concepts come about, with relevant theories and illustrative examples. The concepts will also be further illustrated with worked examples and with real world applications to show the relevance and importance of learning chemistry and its links to other disciplines.
Tutorials	TAs will provide materials containing concepts taught in classes and cover related applications derived from corresponding lectures. You will be assigned to a small group for interactive discussions, which will help you to develop your own critical thinking capability and problem solving skills in a team-based learning environment.
Laboratory	Laboratory session will consist of three main parts. Pre-laboratory exercises will involve online pre-lab quiz to be attempted prior to a lab session and consists of risk assessment and questions based on the lab manual to ensure that students have read and understood the respective experimental description before starting the actual lab session. During the actual lab session students will typically work in pairs and conduct the assigned experiment under the supervision of laboratory TAs following the instructions provided in the lab manual. This will train students in applying concepts learned to real life situations. Subsequent to the lab session you are to submit a individual post-lab report in the prescribed format which will help to develop your critical thinking ability, ability to assimilate, evaluate and present the data gathered during a lab experiment.

# 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): Test/Quiz(Midterm Test 1)	1	Competence and Creativity	7		Individual	Analytic	Not Applicable
2	Continuous Assessment (CA): Test/Quiz(Midterm Test 2)	2-5	Competence and Creativity	7		Individual	Analytic	Not Applicable
3	Continuous Assessment (CA): Class Participation()	1-5	Competence and Creativity	6		Individual	Analytic	Not Applicable
4	Summative Assessment (EXAM): Final exam()	1-6	Competence and Creativity	50		Individual	Analytic	Not Applicable
5	Continuous Assessment (CA): Others(Lab)	6	Competence and Creativity	30	Assignment or Report	Individual	Analytic	Not Applicable

Description of Assessment Components (if applicable)

## Formative Feedback

Formative feedback: Lecturers and TAs will be closely working with you to monitor your learning progress. They will provide you with timely feedback to improve your understanding of concepts. Furthermore, you will be given opportunities to express your ideas and discuss them with lecturers and TAs.

Summative Feedback: Summative feedback on laboratory reports and mid-term tests will be given. For laboratory reports, you will be provided with comments on mistakes, areas of improvement and examples of good practice in scientific writing etc.

This will help you to achieve the intended learning outcomes above.

## NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Creative Thinking	Basic
Problem Solving	Basic
Critical Thinking	Basic



# 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 read the lecture/tutorial/laboratory materials prior to the respective lecture/tutorial/laboratory session. This will help you to learn much more efficiently as you will already have an impression on the topics to be covered. For laboratory sessions, besides reading the laboratory manual and understanding the experimental procedure, you should also complete the risk assessment component of the lab report in which you should list possible hazards and their prevention steps. You should also read through the recommended textbooks as outlined in the Weekly Schedule.

## Policy (Absenteeism)

Absence from laboratory and assessments 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 of cial activities supported by an excuse letter from the relevant bodies and should be submitted to the school. If you miss a lecture, the onus is on you to watch the recorded lecture and clarify any doubt you may still have with the instructor.

## 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](mailto: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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