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

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	AY2021-2022
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Phillip Stephen Grant
Course Author Email	phillip.grant@ntu.edu.sg
Course Title	Organic Chemistry For Engineers
Course Code	CB1103
Academic Units	3
Contact Hours	45
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to teach students organic chemistry at the intermediate level. The course focuses on the fundamentals of bonding in organic compounds and basic reactions of selected organic functional groups with stereochemistry in mind.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Describe orbitals, bonding, hybridization and resonance of organic compounds
ILO 2	Identify the different classes of organic compounds and their reactions and industrial applications
ILO 3	Describe the reaction mechanisms and stereochemistry of different organic reactions
ILO 4	Apply the knowledge to perform organic transformation reactions for synthesis of simple compounds.

Course Content

Key topics taught:

1. Introduction to organic chemistry
2. Stereochemistry
3. Chemistry of alkanes, alkyl halides and alkenes
4. Chemistry of alcohols, esters, phenols, epoxides
5. Chemistry of aromatic compounds and conjugated systems
6. Chemistry of amines, carboxylic acids and derivatives

Reading and References (if applicable)

1. Main Text: Organic Chemistry (6th Edt.) by L.G. Wade.
2. References: Organic Chemistry (6th Edition) by J. McMurry; Organic Chemistry (6th Edition) by Morrison & Boyd; A Guidebook to Mechanisms in Organic Chemistry (5th Edition) by Peter Sykes; The Third Dimension in Organic Chemistry by Alan Bassindale

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction to orbitals, hybridization and bonding in organic compounds	1	Textbook, lecture notes, tutorial questions		
2	Chemistry of alkanes and cycloalkanes	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
3	Stereochemistry	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
4	Chemistry of alkyl Halides	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
5	Chemistry of alkenes and alkynes	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
6	Chemistry of alcohols	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
7	Chemistry of ethers, epoxides and sulfides	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
8	Conjugated Systems	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
9	Benzene and aromaticity	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
10	Reactions of aromatic compounds	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
11	Chemistry of Phenols	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		
12	Chemistry of Amines	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
13	Chemistry of carboxylic Acids and Derivatives	2, 3, 4, 5	Textbook, lecture notes, tutorial questions		

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Lecture will primarily discuss the key concepts related to orbitals, bonding and hybridization, stereochemistry, chemistry of organic compounds including alkanes, alkyl halides and alkenes, alcohols, esters, phenols, epoxides, aromatic compounds and conjugated systems, amines, carboxylic acids and derivatives.
Tutorial	Tutorial questions comprise relevant applications of the concepts introduced in lectures. Students are encouraged to have discussion with the instructor to clarify doubts and to explore reaction schemes.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Continuous Assessment: Quiz 1)	1, 2, 3, 4	b, c, d, f, h	20	Individual	Holistic	Multistructural
2	Continuous Assessment (CA): Test/Quiz(Continuous Assessment: Quiz 2)	1, 2, 3, 4	b, c, d, f, h	20	Individual	Analytic	Multistructural
3	Summative Assessment (EXAM): Final exam(Final Examination (60%) (2hrs Closed Book))	1, 2, 3, 4	b, c, d, f, h	60	Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

Formative Feedback

Examination results;
Marks will be uploaded to NTUlearn.
Quiz answers will be discussed in class. Common mistakes and misunderstanding in concepts will be addressed.

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
Curiosity	Basic
Global Perspective	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)

Students are expected to complete all online activities and take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements. Students are expected to participate in all tutorial discussions and activities.

Policy (Absenteeism)

Continuous assessments make up a significant portion of students' course grade. Absence from continuous assessments without officially approved leave will result in no marks and affect students' overall course grade.

Policy (Others, if applicable)

Continuous assessments: Students are required to attend all continuous assessments.

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 our 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, 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 has any other concerns, please speak to your instructors or a faculty member.

Last Updated Date: 06-09-2024 09:23:54

Last Updated By: Lai Ru Ying

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Last Updated Date: 04-07-2024 06:58:50

Last Updated By: Phillip Stephen Grant (Asst Prof)

Appendix 1: Assessment Criteria

Criteria	Exceed Expectations	Meet Expectations	Meet Baseline Expectations	Below Expectations
LO 1, 2, 3	Demonstrates strong interest of chemical and/or biomedical industry. Exhibits deep understanding of different job roles, responsibilities and skills needed for chemical engineers or bioengineers in a particular industry. Essay is written in a concise, coherent, well-organized and well-structured manner. The format is consistent throughout.	Demonstrates reasonable interest of chemical and/or biomedical industry. Exhibits acceptable understanding of different job roles, responsibilities and skills needed for chemical engineers or bioengineers in a particular industry. Essay is concise, coherent, and organized. The format is consistent throughout.	Demonstrates shallow interest of chemical and/or biomedical industry. Exhibits narrow understanding of different job roles, responsibilities and skills needed for chemical engineers or bioengineers in a particular industry. Essay is organized but the format is inconsistent.	Shows no interest of chemical and/or biomedical industry. Do not exhibit any understanding of different job roles, responsibilities and skills needed for chemical engineers or bioengineers in a particular industry. Essay is unorganized and difficult to comprehend.

Mapping of Course ILOs to EAB Graduate Attributes

Course Code & Title	Organic Chemistry for Engineers CB1103
Course Type	Core; Undergraduate

Overview											
(a)		(b)	●	(c)	●	(d)	●	(e)		(f)	◐
(g)		(h)	◐	(i)		(j)		(k)			

Legend:

●	Fully consistent (contributes to more than 75% of Student Learning Outcome)
◐	Partially consistent (contributes to about 50% of Student Learning Outcome)
O	Weakly consistent (contributes to about 25% of Student Learning Outcome)
Blank	Not related to Student Learning Outcome

Course ILOs		**EAB Graduate Attributes**
1)	Describe orbitals, bonding, hybridization and resonance of organic compounds	b, c, d, f, h
2)	Identify the different classes of organic compounds and their reactions and industrial applications	b, c, d, f, h
3)	Describe the reaction mechanisms and stereochemistry of different organic reactions	b, c, d, f, h
4)	Apply the knowledge to perform organic transformation reactions for synthesis of simple compounds.	b, c, d, f, h
5)		
6)		
7)		
8)		
9)		
10)		

EAB Graduate Attributes

a) **Engineering Knowledge**: Apply the knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems.

b) **Problem Analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences with holistic considerations for sustainable development. (WK1 to WK4)

c) **Design / Development of Solutions**: Design creative solutions for complex engineering problems and design systems, components or processes that meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental considerations as required. (WK5)

d) **Investigation**: Conduct investigations of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern Tool Usage**: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering problems, with an understanding of the limitations. (WK2 and WK6)

f) **The Engineer and the World**: When solving complex engineering problems, analyse and evaluate sustainable development impacts to: society, the economy, sustainability, health and safety, legal frameworks and the environment (WK1, WK5, and WK7).

g) **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (WK9).

h) **Individual and Collaborative Team Work**: Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multidisciplinary, face-to-face, remote and distributed settings (WK9).

i) **Communication**: Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions, taking into account cultural, language, and learning differences.

j) **Project Management and Finance**: Demonstrate knowledge and understanding of engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

k) **Life-long Learning**: Recognise the need for, and have the preparation and ability to (i) engage in independent and life-long learning, and (ii) adapt to new and emerging technologies, and (iii) think critically, in the broadest context of technological change (WK8).

No	Knowledge Profile
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
WK5	Knowledge including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts that supports engineering design and operations in a practice area
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
WK9	Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc with mutual understanding and respect, and of inclusive attitudes

Reference: EAB Accreditation Manual