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 1
Course Author * Faculty proposing/revising the course	Mihaiela Stuparu, Ling Xing Yi
Course Author Email	mstuparu@ntu.edu.sg; xyling@ntu.edu.sg
Course Title	Polymer Chemistry
Course Code	CM4062
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	CM2031 or by permission
Co-requisites	
Pre-requisite to	
Mutually exclusive to	CM9092
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to develop an understanding of the fundamentals in polymer science covering:

- The synthesis and characterisation of polymers, introducing students to polymers, their synthesis and reaction mechanism.
- The relation between chemical structure, polymer morphology and physico-chemical properties, providing the students with an understanding of polymer behaviour in the solid and solution state, as well as characterisation techniques commonly used in polymer science.

It will prepare you for a job in industries where polymer chemistry knowledge is required – from oils, paints and coatings, to food, cleaning agents and cosmetics, to medical, agricultural and aerospace technologies. This course is also great preparation for a PhD and a career in chemistry research.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	use essential descriptions of define, classify, and depict a polymer.
ILO 2	identify the repeat units and structural features of a particular polymers.
ILO 3	explain step-growth polymerization, with respect to synthesis mechanisms, choice of monomer and reaction conditions.
ILO 4	explain chain-growth polymerization, with respect to synthesis mechanisms, choice of monomer and reaction conditions.
ILO 5	suggest the appropriate polymerization method for the synthesis of a desired polymer
ILO 6	suggest the appropriate techniques to characterize a polymer
ILO 7	determine the relationship between the structure and the properties of a polymer
ILO 8	critically review polymer research reports and assess the technical utility and implications of the documented results.
ILO 9	communicate challenges, analysis, and conclusions related to polymer chemistry, both orally and textually

Course Content

1. Introductory Concepts and Definitions
2. Classification of Polymers
3. Step-growth polymerization
4. Chain-growth polymerization
5. Characterization of polymer – Molar mass
6. Structure and morphology of bulk polymers
7. Rheology and mechanical properties

Reading and References (if applicable)

1. Polymers: Chemistry and Physics of Modern Materials, 3rd edition J.M.G.Cowie and Valeria Arrighi, CRC Press, 2007. ISBN-10: 0367092093
2. Polymer Chemistry: An Introduction, 3rd edition Malcolm P. Stevens, Oxford University Press, 1999. ISBN-10: 0195124448
3. Polymer Science & Technology, 3rdd edition Joel R. Fried, Pearson Education, Inc, 2014. ISBN-10: 0137039557
4. Introduction to Physical Polymer Science, 4th edition L.H. Sperling, John Wiley & Son, Inc, 2006. ISBN-10: 047170606X
5. Contemporary Polymer Chemistry, 3rd ed, Harry R. Allcock, Frederick W. Lampe, and James, E. Mark, Pearson Education, Inc, 2003. ISBN-10: 0130650560

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introductory Concepts and Definitions	1, 2			Reading & writing activities, Interactive discussion between students/course instructor
2	Classification of Polymers	1, 2			Reading & writing activities, Interactive discussion between students/course instructor
3	Step-growth polymerization	1, 2, 3, 5			Reading & writing activities, Interactive discussion between students/course instructor
4	Step-growth polymerization	1, 2, 3, 5			Reading & writing activities, Interactive discussion between students/course instructor
5	Chain-growth polymerization	1, 2, 4, 5, 6			Reading & writing activities, Interactive discussion between students/course instructor
6	Chain-growth polymerization	1, 2, 4, 5, 6			Reading & writing activities, Interactive discussion between students/course instructor

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
7	Chain-growth polymerization	1, 2, 4, 5, 6			Reading & writing activities, Interactive discussion between students/course instructor
8	Critically review and present a paper	1- 9			Oral presentation
9	Critically review and present a paper, Oral Midterm Test	1-9			Oral presentation, Assessment
10	Characterization of polymer – Molar mass	1, 2, 6, 7			Reading & writing activities, Interactive discussion between students/course instructor, Responseware
11	Structure and morphology of bulk polymers	1, 2, 6, 7			Reading & writing activities, Interactive discussion between students/course instructor, Responseware
12	Rheology and Mechanical Properties	1, 2, 6, 7			Reading & writing activities, Interactive discussion between students/course instructor, Responseware
13	Written Midterm Test	1, 2, 6, 7			Assessment

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Blended learning and the flipped classroom	This active learning, student-centred approach aims to increase your engagement in learning the principles of Polymer chemistry and Polymer Characterization. Prior to class, you will be required to view online instructional videos in NTULearn that will introduce you to the course content in a systematic way. In class, you will be able to clarify any doubt and expand your understanding and application of the new content by actively participating in meaningful collaborative learning.
ResponseWare	Allow instructor to challenge you during lecture and to achieve instant feedback. It also allows you to review the knowledge point right after the delivery and to master the knowledge in-depth.
Oral midterm test	It is designed as discussion with your course instructor on the content delivered during the lectures. It is intended to develop your critical thinking and your communication skills. Additionally, it will allow you to get an instant feed-back and address some of the problems or misconceptions you may have.
Oral presentation	It is anticipated as an opportunity for you to develop your presentation skills and your team-work spirit.

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(CA1: Assignment Paper Presentation + Peer Evaluation)	8,9	Competence, Communication, Civic mindedness, Critical thinking	30		Individual and Team	Holistic	Extended Abstract
2	Continuous Assessment (CA): Others(CA2: Oral Midterm Test)	1-9	Communication, Competence, Creativity	30		Individual	Analytic	Extended Abstract
3	Continuous Assessment (CA): Test/Quiz(CA3: Written Midterm Test)	1,2,6,7	Communication, Competence, Creativity	30		Individual	Analytic	Extended Abstract
4	Continuous Assessment (CA): Others(Responseware & Class Participation)	1,2,6,7	Communication Competence Creativity	10		Individual	Holistic	Not Applicable

Description of Assessment Components (if applicable)

Please note that by default you would receive the same score as your team. However, your score may vary should there be evidence that you had not contributed to your team.

Formative Feedback

You will be given feedback in two ways:

1. By posting your feedback on the course discussion board.
2. By interactive discussion between students/course instructor during the class time
3. Through face-to-face discussion during the collection of your mid-term paper.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Collaboration	Advanced
Communication	Advanced
Curiosity	Intermediate
Self-Management	Intermediate
Critical Thinking	Intermediate

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 online activities in good time.

Policy (Absenteeism)

If you miss a lecture, you are expected to make up for the lost learning activities. If you are sick and unable to attend your class, you have to:

1. Send an email to the instructor regarding the absence
2. Submit the original Medical Certificate‖ to the administrator. (‖ the medical certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.)

There will be no make-up test. If you miss the mid-term test with approval, the marks obtained in all other assessments attempted will be re-scaled to a base of 100%.

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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Last Updated By: Natasha Bhatia (Dr)