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

Course Overview

Expected Implementation in Academic Year (New format)	AY2026-2027
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Poernomo Gunawan
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Course Title	Specialty Chemicals – From Concept to Commercialization
Course Code	CB4251
Academic Units	3
Contact Hours	39
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 module offers a comprehensive introduction to the specialty chemicals industry, emphasizing the product development journey from concept to commercialization. You will explore the unique characteristics of specialty chemicals, market dynamics, regulatory frameworks, innovation processes, intellectual property strategies, sustainability considerations, and real-world industry practices. The module is designed based on current real industry practices, and therefore includes case studies, industry engagement, and a site visit to reinforce learning. This course is tailored to provide a basic background for students who would like to explore & learn potential career development in the specialty chemical industries.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Describe the typical business operation of a specialty chemical industry, identify the value propositions of typical products and formulations, and emerging technology trends in this field.
ILO 2	Describe / design a conceptual product or formulation development plan for a specialty chemical industry, from idea to manufacturing and commercialization.
ILO 3	Evaluate key considerations for commercializing a specialty chemical product.

Course Content

1. Introduction to Specialty Chemicals: definitions, typical organization structure (incl. job family), unique selling propositions of the products
2. Applications in Industry Sectors. Case study examples in key applications such as personal care, agriculture, automotive and others.
3. Specialty Chemicals in the Value Chain: market view, competitive landscape and trends.
4. Innovation at Specialty Chemicals: product, process, application & business innovation.
5. Introduction on stage-gate process for product development in the specialty chemical industry.
6. Key factors to introduce a new product to commercialization stage, including: scale-up & transfer lab recipe to manufacturing facility, regulatory frameworks, intellectual property (IP), sustainability concept (greenhouse gas emissions scope 1-2-3).
7. Example of emerging technologies deployed for the manufacturing of Specialty Chemicals, e.g. biotechnology, digitalization.

Reading and References (if applicable)

Reference reading (articles, websites etc) linked to key topics will be provided to students during the course.These will provide background information on the topic and could be used to draw questions for the exam.

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Introduction to Specialty Chemicals	1	In-person	Classroom lecture	Lecture notes
2	From Molecule to Customer Value	1,2	In-person	Classroom lecture, case study	(1) Lecture notes, (2) Companies website
3	Industry application & value chains	1,2	In-person	Classroom lecture, case study	(1) Lecture notes, (2) Companies website
4	Quiz 1 Introduction of Group Project	1	In-person	Quiz, classroom lecture	
5	Innovation at Specialty Chemicals Part 1	2	In-person	Classroom lecture, group work	Lecture notes
6	Innovation at Specialty Chemicals Part 1 Scale-up & transfer to manufacturing	2	In-person	Classroom lecture, group work	Lecture notes
7	Scale-up & transfer to manufacturing Tentative: company site visit	2	In-person	Classroom lecture	Lecture notes
8	Commercialization Consideration: sustainability	3	In-person	Classroom lecture, group work	Lecture notes
9	Quiz 2 Commercialization Consideration: Intellectual Property strategy	3	In-person	Quiz, classroom lecture	Lecture notes

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
10	Commercialization Consideration: regulatory framework	3	In-person	Classroom lecture, group work	Lecture notes
11	Trend in specialty chemicals – Part 1	3	In-person	Classroom lecture, group work	Lecture notes
12	Trend in specialty chemicals – Part 2	3	In-person	Classroom lecture, group work	Lecture notes
13	Group work presentation & reflection/discussion	1,2,3	In-person	Group presentation	Nil

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Interactive classroom lecture	Through interactive in-class discussions, you will engage with peers and the instructor to explore current industrial practices in the specialty chemical industry. These sessions encourage active participation and provide opportunities to connect theoretical concepts with real-world examples. Where relevant, the instructor will share insights from over 15 years of industry experience to enrich your understanding. Supports ILOs: 1, 2, 3
Case studies & group work	You will examine three case studies from industrial applications (e.g personal care, agriculture, and automotive sectors) to understand the unique attributes and innovation processes of specialty chemicals. In Week 4, you will form working groups, each focusing on one case study. Over Weeks 4 to 12, your group will build a conceptual development plan, incorporating innovation, scale-up, regulatory, and IP considerations. In Week 13, each group will present a conceptual strategy for commercializing a specialty chemical product. Supports ILOs: 1, 2, 3
Tentative company's site visit	Depending on the company's time schedule, you will participate in a site visit to one of Evonik's facilities in Singapore. This visit allows you to observe real-world operations and reflect on how classroom concepts apply to industrial practice. Post-visit discussions will help reinforce your learning and connect theory with practice. Supports ILOs: 1, 2, 3

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(In class short quiz)	1,2,3	a, b, c, d	15		Individual	Holistic	Not Applicable
2	Continuous Assessment (CA): Test/Quiz(Quiz 1)	1	a, b, c, d	25		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(Quiz 2)	1,2	a, b, c, d	25		Individual	Analytic	Relational
4	Continuous Assessment (CA): Project(Group Project and Presentation)	1,2,3	a, b, c, d, h, i	35		Team	Holistic	Extended Abstract

Description of Assessment Components (if applicable)

The course is graded based on 100% Continuous Assessment, which comprises on in-class short quiz that is administered weekly, two individual quizzes in week 4 and week 9, and Group project.

Formative Feedback

You will receive formative feedback throughout the module in the following ways:

- Following Quiz 1 & 2, you will receive both verbal and written feedback from the instructor to support your learning and deepen your understanding of the module.
- During group work sessions, you will receive verbal feedback from the instructor to guide your project development and clarify concepts.
- Following the (optional) site visit, you will engage in a discussion session where feedback will be provided on how well you connect industry observations with course content.
- During final group presentations, you will receive verbal feedback on your presentation skill, communication, integration of concepts, and strategic thinking.

You are encouraged to proactively seek feedback during and outside of class sessions to support your learning and development.

NTU Critical Core Skills+ Mapping

This course intends to develop the following Critical Core Skills+ (maximum 5 most relevant)

Critical Core Skills+	Level
Care for Environment	Intermediate
Curiosity	Intermediate
Learning Agility	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 assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation 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. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

Technical Skills To Be Developed

All skills to be developed for this course:

Chemical Processing
Intellectual Property Strategy
Market Evaluation

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