City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	**Fuel Processing**
Course Code:	**SEE6124**
Course Duration:	**One semester**
Credit Units:	**3 credits**
Level:	**P6**
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**Nil**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

This course will deliver a comprehensive knowledge of the technologies and chemical processes employed in a modern oil refinery for the refining of crude oil, mainly for the production of liquid transport fuels (gasoline, diesel and kerosene/jet fuels). The course will also provide a working knowledge of the emerging biorefinery for refining of biomass or bio-wastes (agricultural/forestry residues, organic solid wastes, microalgae, etc.) into biofuels and bio-based chemicals, focusing on biomass gasification into syngas gas (H_2 + CO), catalytic conversion of syngas into liquid fuels (e.g., Fischer Tropsch, methanol), biomass liquefaction into bio-oils, and bio-oil upgrading. This course will enable the students to solve technology-specific problems and develop critical thinking of new technological solutions towards carbon neutrality through the learning of biorefinery knowledge and carrying out a research proposal project.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Acquire a comprehensive knowledge of oil refining and auxiliary processes in a modern oil refinery.	50%	✓		
2.	Develop critical thinking of how the emerging biorefining technologies will contribute to carbon neutrality.	25%		✓	
3.	Demonstrate ability to write/present a research proposal for improving the efficiency of a conversional fuel processing process, or for developing a new biorefinery process to produce biofuels and bio-based chemicals from biomass or bio-wastes.	25%	✓	✓	✓
		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.			Hours/week (if applicable)
		1	2	3	
Lectures/ assignments	Explain the technologies and chemical processes employed in a modern oil refinery for the	✓	✓	✓	

	refining of crude oil, mainly for the production of liquid transport fuels (gasoline, diesel and kerosene/jet fuels), and key concepts of biorefinery; Solidify students' understandings with practical examples, real cases, class assignments and discussions.				
Term paper	Develop students' ability to write a research proposal for improving the efficiency of a conversional fuel processing process, or for developing a new biorefinery process to produce biofuels and bio-based chemicals from biomass or bio-wastes, and to develop critical thinking of how biorefining technologies can contribute to carbon neutrality.	✓	✓	✓	
Presentation	Improve students' communication skills to effectively present and defend a research proposal proposed by themselves.			✓	

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.			Weighting	Remarks
	1	2	3		
Continuous Assessment: 55%					
Assignments	✓	✓	✓		
Term paper	✓	✓	✓		
Presentation	✓	✓	✓		
Examination: 45% (duration: 3 hours, if applicable)					
				100%	

To pass a course, a student must do ALL of the following:

1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Ability to solve problems related to lecture material	Excellent ability to analyze and solve problems related to lecture material	Good ability to analyze and solve problems related to lecture material	Acceptable ability to analyze and solve problems related to lecture material	Poor ability to analyze and solve problems related to lecture material	Failure to demonstrate analysis and problem-solving ability
2. Final exam	Ability to explain concepts, analyze and solve problems related to fuel processing technologies and processes	Excellent understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Good understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Acceptable understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Poor understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Failure to demonstrate understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes
3. Term paper and presentation	Ability to propose and present a research proposal project on fuel processing technologies and processes	Excellent project design, proposal writing and presentation	Good project design, proposal writing and presentation	Be able to design, describe, and present the project	Poor performance in designing, describing, and presenting the project	Failure to design, describe, or present the project
…						

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignments	Ability to solve problems related to lecture material	Excellent ability to analyze and solve problems related to	Good ability to analyze and solve problems related to lecture	Acceptable ability to analyze and solve problems related to	Poor ability to analyze and solve problems related to lecture

		lecture material	material	lecture material	material
2. Final exam	Ability to explain concepts, analyze and solve problems related to fuel processing technologies and processes	Excellent understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Good understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Acceptable understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes	Failure to demonstrate understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes
3. Term paper and presentation	Ability to propose and present a research proposal project on fuel processing technologies and processes	Excellent project design, proposal writing and presentation	Good project design, proposal writing and presentation	Be able to design, describe, and present the project	Failure to design, describe, or present the project

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- Oil refinery industry and processes
- Thermophysical properties of crude oils and petroleum fractions
- Atmospheric and vacuum distillations
- Catalytic Reforming
- Hydrotreating
- Catalytic Hydrocracking
- Catalytic Cracking
- Alkylation
- Isomerization
- Delayed Coking
- Flexicoking
- Visbreaking
- Biomass Gasification
- Syngas Gas Catalytic Conversion
- Biomass Liquefaction
- Bio-oil Upgrading

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Mohamed A. Fahim, Taher A. Alsahhaf and Amal Elkilani, *Fundamentals of Petroleum Refining*, Elsevier Science, 2010. **DOI**: https://doi.org/10.1016/C2009-0-16348-1 (Free to download)

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

Nil