SEE6124: FUEL PROCESSING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Fuel Processing

Subject Code
SEE - School of Energy and Environment
Course Number
6124

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

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 (H2 + 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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Acquire a comprehensive knowledge of oil refining and auxiliary processes in a modern oil refinery.	50	x		
2	Develop critical thinking of how the emerging biorefining technologies will contribute to carbon neutrality.	25		x	
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	x	x	x

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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	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.	1, 2, 3	

2	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.	1, 2, 3	
3	Presentation	Improve students' communication skills to effectively present and defend a research proposal proposed by themselves.	3	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3	20	Summative Assessment	No
2	Mid-term exam	1, 2, 3	40	-	No
3	Term paper	1, 2, 3	20	-	Yes
4	Presentation	1, 2, 3	20	-	Yes

Continuous Assessment (%)

100

Examination (%)

0

Minimum Continuous Assessment Passing Requirement (%)

30

Additional Information for ATs

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.

Assessment Rubrics (AR)

Assessment Task

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to solve problems related to lecture material

Excellent

(A+, A, A-) Excellent ability to analyze and solve problems related to lecture material

Good

(B+, B, B-) Good ability to analyze and solve problems related to lecture material

Fair

(C+, C, C-) Acceptable ability to analyze and solve problems related to lecture material

Marginal

(D) Poor ability to analyze and solve problems related to lecture material

Failure

(F) Failure to demonstrate analysis and problem-solving ability

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Assessment Task

Mid-term exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to explain concepts, analyze and solve problems related to fuel processing technologies and processes

Excellent

(A+, A, A-) Excellent understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Good

(B+, B, B-) Good understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Fair

(C+, C, C-) Acceptable understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Marginal

(D) Poor understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Failure

(F) Failure to demonstrate understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

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Assessment Task

Term paper and presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to propose and present a research proposal project on fuel processing technologies and processes

Excellent

(A+, A, A-) Excellent project design, proposal writing and presentation

Good
(B+, B, B-) Good project design, proposal writing and presentation

Fair
(C+, C, C-) Be able to design, describe, and present the project

Marginal
(D) Poor performance in designing describing and presenting the project

Failure
(F) Failure to design, describe, or present the project

Assessment Task
Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to solve problems related to lecture material

Excellent
(A+, A, A-) Excellent ability to analyze and solve problems related to lecture material

Good
(B+, B) Good ability to analyze and solve problems related to lecture material

Marginal
(B-, C+, C) Acceptable ability to analyze and solve problems related to lecture material

Failure
(F) Poor ability to analyze and solve problems related to lecture material

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Assessment Task
Mid-term exam (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to explain concepts, analyze and solve problems related to fuel processing technologies and processes

Excellent
(A+, A, A-) Excellent understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Good
(B+, B) Good understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Marginal
(B-, C+, C) Acceptable understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Failure
(F) Failure to demonstrate understanding of concepts and ability to analyze and solve problems related to fuel processing technologies and processes

Assessment Task
Term paper and presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to propose and present a research proposal project on fuel processing technologies and processes

Excellent
(A+, A, A-) Excellent project design, proposal writing and presentation

Good
(B+, B) Good project design, proposal writing and presentation

Marginal
(B-, C+, C) Be able to design, describe, and present the project

Failure
(F) Failure to design, describe, or present the project

Part III Other Information

Keyword Syllabus
- 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

Reading List

Compulsory Readings

	Title
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)

Additional Readings

	Title
1	Nil