

## Template syllabus of the revised courses

**Course Name : Introduction to Oil and Gas Industry & Sustainable Development**

**Number of credits : 3 ECTS**

**Period: Spring semester**

Coordinator	<b>Haizatul Hafizah Hussain</b>
Credits	2 credit hours (3 ECTS)
Lecturers	<b>Haizatul Hafizah Hussain, Muhammad Azfar Mohamed, Asif Zamir, Subarna Sivapalan</b>
Level	Undergraduate
Host institution	Universiti Teknologi PETRONAS
Course duration	12 weeks
New/revised	Revised

### Summary

Introduction to Oil and Gas Industry & Sustainable Development course is a university requirement course, which is compulsory for all first-year undergraduate students of Universiti Teknologi PETRONAS (UTP). This 3 ECTS (approximately 2 credit hours) course aspire to introduce the oil and gas industry environment added with sustainable development perspectives. There are nine topics altogether in this course, where six topics are related to the oil and gas industry, whereas three topics are covered under the sustainable development area. One MARE topic, Marine Pollution Control and Management is also added in this course, which aims to provide an overview to the students on the impacts of oil and gas activities to the marine ecosystem. It also presents environment awareness on the effects of hydrocarbon exploration, and briefly describes on the rules and regulations in marine pollution management. The course is delivered online, via two methods, i.e. self-learning with video presentations, and guided learning by course lecturers.

### Target student audiences

First year of undergraduate students majoring in various engineering, science, technology and business management disciplines, which include the following programmes:

Bachelor of Mechanical Engineering with Honours  
 Bachelor of Petroleum Engineering with Honours  
 Bachelor of Civil Engineering with Honours  
 Bachelor of Chemical Engineering with Honours  
 Bachelor of Electrical and Electronics Engineering  
 Bachelor of Materials Engineering with Honours  
 Bachelor of Computer Engineering with Honours  
 Bachelor of Information Systems (Hons)  
 Bachelor of Information Technology (Hons)  
 Bachelor of Computer Science (Hons)  
 Bachelor of Science (Hons) in Petroleum Geoscience  
 Bachelor of Science (Hons) in Applied Chemistry  
 Bachelor in Business Management

### Prerequisites

Required courses (or equivalents): None



## Aims and objectives

The main course objective is to introduce the various aspects of the oil and gas industry and sustainability throughout the life cycle of the industry. The topics covered are oil and gas search and discovery, production, processing. For downstream, oil and gas refining into petroleum and petrochemical products and feedstock's are introduced. The course also focuses on principles of sustainable development and the aspects of renewable energy for a sustainable future. Finally, topic on marine pollution control and management is also included to give an overview of the environmental impact of oil and gas activities to the marine ecosystem.

## The Authentic Tasks are:

### General learning outcomes:

By the end of the course, successful students will be able to:

1. Describe the various steps of the petroleum industry life cycle and understand which disciplines are involved at each step.
2. Explain how oil and gas are discovered and produced.
3. Explain how oil and gas are processed and transported.
4. Describe how oil and gas are refined into various petrol and petrochemical products and exported.
5. List principles of sustainable development and describe various types of footprint with the role of engineers in industry.
6. Identify various types of renewable energy and the relation with sustainable development.
7. List the impacts of oil and gas activities on the marine environment, explain on the awareness on the effects of hydrocarbon exploration, and list the rules and regulations in marine pollution management.

## Overview of sessions and teaching methods

The course will make most of interactive and self-reflective methods of teaching and learning.

- Learning methods**
- Video presentations via ULearn platform (Moodle)
  - Self-Learning via ULearn platform (Moodle)
  - Guided Learning via Microsoft Teams
  - Adjunct Lecture

## Course outline

### Topic 1

#### Oil and Gas Industry Life Cycle

- Overview of world energy demand and supply • Upstream • Field life cycle • Midstream
- Transportation • LNG • Oil & Gas processing and treatment • Downstream • Refinery • Petrochemical products • Economic impacts of petroleum industry • Importance of energy by sources • Demand and supply (OPEC and non-OPEC countries)

### Topic 2

#### Introduction to Oil and Gas Exploration

- Origin of petroleum • Rock cycle • Sedimentary basin • Conventional and unconventional reservoirs • Petroleum system Elements • Exploration techniques • Magnetic techniques • Gravimetric survey • Seismic method • Exploration and appraisal well

### Topic 3

#### Oil and Gas Recovery Techniques

- Reservoir rock and fluid properties • Oil recovery techniques • Primary recovery methods • Secondary recovery methods • Tertiary recovery methods • Reservoir



management • Reservoir Surveillance and monitoring • Reservoir modeling and simulation • Reservoir management team

#### **Topic 4**

##### **Drilling Operations and Equipment**

• Introduction to drilling • Well classification • Exploratory well • Appraisal well • Development well • Drilling rig personnel • Types of drilling rig • Onshore rigs • Offshore rigs • Drilling rig components • Drillstring components • Drilling sequence • Types of well completion

#### **Topic 5**

##### **Production Operations and Facilities**

• Wellhead equipment • Gathering system • Oil and gas separation processes • Produced water treatment • Pumps and compressors • Metering/Fiscalisation • Oil and gas storage tanks • Artificial lift methods • Production team

#### **Topic 6**

##### **Downstream Processes**

• Overview of oil and gas transportation • crude oil composition • crude oil distillation • Feedstock to petrochemical processes • petrochemical products and usage • Supply and demand of petrochemical products • Role of disciplines in downstream process

#### **Topic 7**

##### **Marine Pollution Control and Management (MARE topic)**

Marine Pollution Control and Management - The content will be emphasizing on the impacts of oil and gas activities on the marine environment and to create awareness on the effects of hydrocarbon exploration in a long term. Rules and regulations in marine pollution management is also added (Environmental Quality Act 1974), as well as addressing sustainable development goals.

#### **Topic 8**

##### **Principles of Sustainable Development**

• Definition and Brundtland report • Principles • SDG 17 goals • Triple bottom lines in SD

#### **Topic 9**

##### **Current Issues in Sustainable Development**

• Importance of energy • Poverty and water scarcity • Water recycling and reuse • Energy security • Carbon emission and carbon footprint • Kyoto protocol • COP France • Impact of climate change – global warming • Ecological footprint

#### **Topic 10**

##### **Renewable Energy for Sustainable Future**

• Importance of clean energy • Future sources of renewable energy • Wind • Solar • wave • Nuclear energy source • Our responsibility for a sustainable future

## Literature

Recommended:

1. Hyne N. J. (2012). Nontechnical guide to petroleum geology, exploration, drilling and production, 3rd ed., Norman J Hyne.
2. Introduction to Petroleum Technology, INSTEP Training Module for PETRONAS staff (2007).
3. How the energy industry works: an insiders' guide. 2007.
4. Dewulf, J. and Langenhove, H.V. (2014), 'Renewable-Based Technology', John Wiley and Sons Inc.
5. Pfister, T., Schweighofer, M. and Reichel, A. (2016). 'Sustainability', Abingdon, Oxon : Routledge.

## Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
<b>In-class activities (24 hours)</b>			
Guided Learning and Moderated in-class discussions	1. Describe the various steps of the petroleum industry life cycle and understand which disciplines are involved at each step	Class participation and preparedness for discussions	2
Guided Learning and Moderated in-class discussions	2. Explain how oil and gas are discovered and produced.	Class participation and preparedness for discussions	4
Guided Learning and Moderated in-class discussions	3. Explain how oil and gas are processed and transported.	Class participation and preparedness for discussions	6
Guided Learning and Moderated in-class discussions	4. Describe how oil and gas are refined into various petrol and petrochemical products and exported.	Class participation and preparedness for discussions	4
Guided Learning and Moderated in-class discussions	5. List principles of sustainable development and describe various types of footprint with the role of engineers in industry.	Class participation and preparedness for discussions	4
Guided Learning and Moderated in-class discussions	6. Identify various types of renewable energy and the relation with sustainable development.	Class participation and preparedness for discussions	2
Guided Learning and Moderated in-class discussions	7. List the impacts of oil and gas activities on the marine environment, explain on the awareness on the effects of hydrocarbon exploration, and list the rules and regulations in marine pollution management.	Class participation and preparedness for discussions	2
<b>Independent work (80 hours)</b>			
Self-Learning (Independent Learning)	1. Describe the various steps of the petroleum industry life cycle and understand which disciplines are involved at each step	Quizzes and Tests	6
Self-Learning (Independent Learning)	2. Explain how oil and gas are discovered and produced.	Quizzes and Tests	12
Self-Learning (Independent Learning)	3. Explain how oil and gas are processed and transported.	Quizzes and Tests	21



Self-Learning (Independent Learning)	4. Describe how oil and gas are refined into various petrol and petrochemical products and exported.	Quizzes and Tests	12
Self-Learning (Independent Learning)	5. List principles of sustainable development and describe various types of footprint with the role of engineers in industry.	Quizzes and Tests	9
Self-Learning (Independent Learning)	6. Identify various types of renewable energy and the relation with sustainable development.	Quizzes and Tests	13
Self-Learning (Independent Learning)	7. List the impacts of oil and gas activities on the marine environment, explain on the awareness on the effects of hydrocarbon exploration, and list the rules and regulations in marine pollution management.	Quizzes and Tests	7
<b>Total</b>			<b>104</b>

### Grading

The students' performance will be based on the following:

#### Assessment

- Quizzes (40%)
- Tests (60%)

There is no Final Examination for this course. Grading is 100% by Coursework.

#### Evaluation

- A (85 - 100)
- A- (80 – 84.9)
- B+ (75 – 79.9)
- B (65 – 74.9)
- C+ (55 - 64.9)
- C (50 – 54.9)
- D+ (45 – 49.9)
- D (40 – 44.9)
- F (<40)