

Mission:

- Course overview:

This course comprehensively introduces the essential equipment and systems used throughout the petroleum industry. Over eight weeks, participants will explore the design, functionality, and operation of machinery critical to upstream, midstream, and downstream activities. The course begins with an overview of static and rotating equipment and the interpretation of piping and instrumentation diagrams (P&IDs). Key modules cover exploration and drilling tools, such as drilling rigs, wellhead systems, and safety valves, followed by production and refining equipment, including separators, distillation columns, and heat exchangers. Midstream topics focus on pipelines, compressors, and metering systems, while safety and environmental systems—such as gas detectors, fire suppression, and pollution control devices—are emphasised throughout. Participants will also gain insights into instrumentation, control systems, and maintenance tools, preparing them to optimise operations. This course is ideal for professionals seeking expertise in petroleum equipment operations and safety.

- Course objective:

The objective of this course is to provide participants with a thorough understanding of the equipment and systems used in the petroleum industry, spanning exploration, production, transportation, refining, and storage. Participants will develop the technical knowledge and practical skills needed to analyse, operate, and maintain machinery essential to upstream, midstream, and downstream operations. By the end of the course, participants will be able to make informed decisions to enhance operational efficiency, safety, and sustainability in petroleum industry processes.

The course aims to:

1. Equip participants with the ability to identify and explain the functions of various petroleum industry equipment, including static, rotating, and safety systems.
2. Teach the interpretation of Piping and Instrumentation Diagrams (P&IDs) for process design and equipment integration.
3. Provide an in-depth understanding of exploration, production, refining, transportation, and storage equipment.
4. Emphasize the importance of safety, environmental stewardship, and compliance with industry standards in equipment operation.
5. Introduce advanced tools for monitoring, maintenance, and optimization of petroleum machinery.

Student's obligation

Students must be prepared to ask and answer questions during lectures regarding the materials as they are covered. In addition to class lectures based on material in the textbook, we may cover material in more detail or discuss recent modifications in refineries beyond what is covered in the textbook. In these cases, supplementary course material will be provided to the student as handouts or web links. Discusses students' suggestions, opinions, and questions during teacher office hours. In addition, a continuous system of quizzes is applied throughout the academic year to evaluate the student's progress. Students are also required to Prepare reports, seminars, and other activities.

- Forms of teaching

In this course the following materials are used as teaching assistance :

- A PC and data show to show the lecture content and display related videos.
- Whiteboard might be used to explain the subjects of the lectures.

- Assessment scheme

24% Mid. Theory exam

8% Quiz

10% Homework

16% Reports and Seminars

2% Attendance

40% final theory

1. Specific learning outcome:

2. By the end of this course, participants will be able to:
3. Understand Equipment Categories: Classify and explain the roles of static and rotating equipment in petroleum industry operations.
4. Interpret Piping and Instrumentation Diagrams (P&IDs): Analyze and apply P&IDs for equipment identification, process design, and system integration.
5. Describe Exploration and Drilling Equipment: Demonstrate knowledge of tools such as drilling rigs, wellhead systems, and safety valves, and their applications in upstream operations.
6. Evaluate Production and Refining Equipment: Explain the functionality of subsurface pumps, separators, distillation columns, and catalytic converters in production and processing activities.
7. Analyze Midstream Operations: Describe the operation and maintenance of pipelines, compressors, and metering systems in petroleum transportation.
8. Apply Safety and Environmental Protocols: Identify and recommend safety systems, such as emergency shutdown devices and fire suppression systems, to mitigate risks and environmental impacts.
9. Utilize Instrumentation and Control Systems: Implement knowledge of control panels, sensors, and SCADA systems to optimize equipment performance and system monitoring.
10. Plan Maintenance Strategies: Use non-destructive testing (NDT) tools and predictive maintenance techniques to enhance equipment reliability and longevity.
11. Assess Environmental Control Systems: Evaluate systems like vapor recovery units and water treatment plants to ensure compliance with environmental regulations.

Course Reading List and References:

1. Devold, H., 2013. Oil and gas production handbook: an introduction to oil and gas production. Lulu. com.
2. Grace, R.D., 2013. Oil: an overview of the petroleum industry.

Course topics (Theory)	Week	Learning Outcome
<p><u>Introduction to Petroleum Industry Equipment</u> Overview of the petroleum industry. Key units, static equipment (e.g., tanks), and rotating equipment (e.g., pumps and compressors)</p>	1	Understand petroleum equipment types, units, and roles of static and rotating machinery in industrial operations.
<p><u>Piping and Instrumentation Diagrams (P&IDs)</u> Introduction to P&IDs: Symbols, process flow, and equipment integration.</p>	2	Interpret P&IDs for process flow, equipment identification, and system integration within petroleum operations
<p><u>Exploration and Drilling Equipment</u> Overview of drilling rigs, drill bits, and mud pumps. Wellhead systems, Christmas trees, surface safety valves, and manifolds.</p>	3	Explain exploration and drilling tools, including wellhead systems, surface safety valves, and drilling rigs.
<p><u>Production Equipment</u> Subsurface pumps, separators, and gas compressors. Storage tanks and their roles in production processes.</p>	4	Describe production equipment, such as separators, gas compressors, subsurface pumps, and storage tanks.
<p><u>Refining and Processing Equipment</u> Refining Definition and Purpose, Refining Processes, Refinery configuration, Distillation, Distillation Columns, Basic Operation, Atmospheric Distillation, Vacuum Distillation, Crude Oil Distillation Products and uses.</p>	5	Analyze refining equipment, including distillation columns, reactors, heat exchangers, and catalytic converters.
<p><u>Pipeline and Transportation Equipment</u> Pipelines and their components, including pumps, compressors, and metering stations.</p>	6	Identify pipeline systems, pumps, compressors, and metering stations used in petroleum transportation.
<p><u>Storage Facilities</u> Overview of above-ground (ASTs), underground (USTs), and floating storage units (FSUs)</p>	7	Understand storage systems, including above-ground, underground, and floating

		storage facilities.
<u>Safety and Environmental Equipment</u> Emergency shutdown systems (ESD), gas detectors, fire suppression, and spill containment systems.	8	Apply safety systems like ESDs, gas detectors, fire suppression, and spill containment measures in petroleum facilities.
<u>Safety and Environmental Equipment</u> Emergency shutdown systems (ESD), gas detectors, fire suppression, and spill containment systems.	9	Utilize control systems, including SCADA, DCS, sensors, and transmitters, for effective equipment monitoring and operations.
<u>Instrumentation and Control Systems</u> Control panels, Distributed Control Systems (DCS), sensors, transmitters, and SCADA systems.	10	Employ maintenance tools, including NDT equipment, lubrication systems, and predictive maintenance strategies, to ensure equipment reliability.
<u>Environmental Control Devices</u> Flare systems, vapor recovery units, air pollution control, and water treatment systems.	11	Assess environmental control devices like flare systems, vapor recovery units, and water treatment systems for pollution mitigation.

