



<b>Course Code</b> OGEE-450	<b>Course Title</b> Hydrocarbon Flow Assurance	<b>ECTS Credits</b> 6
<b>Department</b> Engineering	<b>Semester</b> Fall, Spring	<b>Prerequisites</b> MENG-280
<b>Type of Course</b> Elective	<b>Field</b> Oil & Gas Engineering	<b>Language of Instruction</b> English
<b>Level of Course</b> 1 <sup>st</sup> Cycle	<b>Year of Study</b> 4 <sup>th</sup>	<b>Lecturer(s)</b> Dr Constantinos Hadjistassou
<b>Mode of Delivery</b> Face-to-face	<b>Work Placement</b> N/A	<b>Co-requisites</b> None

**Objectives of the Course:**

- The main objectives of the course are to:
- Introduce students to the importance of flow assurance during oil and natural extraction and transport operations;
  - Explain the technical hazards and economic risks to flowline, pipeline and other equipment attributed to wax and natural gas hydrate formation;
  - Outline the chemistry of wax and gas hydrate generation, prevention and inhibition strategies including stream dehydration, temperature and pressure control and chemical use;
  - Present the parameters which define the in/effectiveness of chemical introduction (e.g., methanol and glycols) in the context of economic and flow risk considerations;
  - Determine the amount of chemical compounds necessary to inhibit gas hydrate formation;
  - Cover the effectiveness of the introduction of thermodynamic inhibitors, kinetic hydrate inhibitors and anti-agglomerants;
  - Illustrate the concepts of passive thermal insulation and active pipeline heating through temperature calculations;
  - Highlight well and equipment maintenance and care due to chemical introduction.

**Learning Outcomes:**

- After completion of the course students are expected to:
- Appreciate the importance of flow assurance during the petroleum production and transmission phases;
  - Understand the engineering and financial risks that wax and gas hydrates pose to flowlines, pipelines and other equipment;
  - Gain an insight into the chemistry of wax and gas hydrate generation, prevention and inhibition techniques such as stream dehydration, temperature and pressure

control and chemical use;

- Identify the parameters which govern the in/effectiveness of chemical use such as methanol and glycols and their impact on economic and flow risk;
- Estimate the quantity of chemical compounds necessary to inhibit gas hydrate formation;
- Comprehend the efficiency of thermodynamic inhibitors, kinetic hydrate inhibitors and anti-agglomerants;
- Recognize the importance of non-active thermal insulation and active pipeline heating systems through temperature calculations;
- Suggest well and equipment maintenance practices for the care of equipment due to chemical introduction.

### **Course Contents:**

- Examples of flow blockage incidents during petroleum production and transmission operations and their impact on project profitability & timelines;
- Types of flow through conduits, operational conditions of pipelines, impact on energy of wax and hydrate formation, environmental hazards, time delays, etc;
- Chemical and physical characteristics of wax and gas hydrate formation, stream and petroleum dehydration, temperature and pressure control and chemical use;
- Particulars of methanol and glycols, chemical behavior, mixing and separation issues, economic and flow risks;
- Estimate the amount of chemical compounds intended to inhibit or minimize gas hydrate formation;
- Thermodynamic inhibitors, kinetic hydrate inhibitors and anti-agglomerants;
- Pipe-in-pipe insulation, pipeline burying, bundled configurations, electrical heating methods, temperature calculation examples;
- Equipment maintenance practices, equipment care and chemical introduction side-effects;
- Restrictions in flow- and pipe-lines productivity, physical damage to chokes, valves, and instrumentation hardware.

### **Learning Activities and Teaching Methods:**

Lectures, Projects, Discussion

### **Assessment Methods:**

Homework, Project assignments, mid-term exam, final exam.

### **Required Textbooks/Reading:**

<b>Authors</b>	<b>Title</b>	<b>Publisher</b>	<b>Year</b>	<b>ISBN</b>
Gas Processors Suppliers Association (GPSA)	Engineering Data Book, 12th ed.	GPSA	2004	978 999 809 55 33

**Recommended Textbooks/Reading:**

<b>Authors</b>	<b>Title</b>	<b>Publisher</b>	<b>Year</b>	<b>ISBN</b>
Saeid Mokhatab, William A. P, and James G. S.	Handbook of Natural Gas Transmission and Processing	Gulf Professional Publishing	2006	978 0 7506 7776 9
Islam, R., Chhetri A. B., and Khan, M. M.	The Greening of Petroleum Operations	John Wiley & Scrivener	2010	978 0 470 62590 3