DHRTC Summer School on Mature Oil Fields 2018

Course objectives

Week 32 (DTU)

General course objectives

The course gives the students an understanding of the mature oil fields, their challenges, technological advances, seismic analysis, scale and corrosion, reservoir chalk geology, geophysics and geostatistics, chemistry and characterization of petroleum mixtures, and enhanced oil recovery methods.

Learning objectives

A student who has met the objectives of the course will be able to:

- Achieve understanding of solutions to improving oil and gas recovery in the Danish mature fields (e.g. depletion with vertical wells, water flooding, advanced seismic analysis etc.) through DUC, Total DK technology strategy and the research based innovation at DHRTC
- Demonstrate an understanding of chemical thermodynamics and salt solutions
- Demonstrate an understanding of occurrences and types of corrosion in mature fields and corrosion mechanisms as well as the mitigation methods
- Demonstrate an understanding of Scale types and occurrence in North Sea wells and monitoring
- Describe the background for chalk sedimentation and processes involved; and physical properties of the chalk sedimentation as well as fractures and their effects on flow
- Describe the K/T boundary and what it tells about an important event in Earth's history
- Demonstrate an understanding of the mechanisms behind the chemical processes taking place in an oil reservoir and the tools for addressing their importance
- Demonstrate an understanding the properties of petroleum fluids: what they consist of, how they behave under varying temperature and pressure, how their properties may be measured and modelled
- Describe the modern methods of enhanced oil recovery: How we can produce more oil by application of the chemicals, or gases, or by thermal methods?
- Demonstrate an understanding of Geophysics and geostatistics: geophysical modelling and creating a reservoir model from geophysics and geostatistics.

Day-to-day objectives:

Monday – Introduction to the Danish mature fields (Total DK experts and Morten Jeppesen)
Knowledge on the technological evolution for improvement in oil and gas recovery from the Danish chalk fields, maintenance challenges of equipment, environmentally responsible operation, Total DK's technology strategy and the research based innovation at DHRTC for improved O&G recovery.

Tuesday – Corrosion and scale (Karen Feilberg and Philip Fosbøl):
An overview of scale and corrosion types and mechanisms. An understanding of the mitigation techniques materials and the associated costs and basic understanding of the chemical and physical processes in in the wells. The scale session entails the concepts of scaling and electrolyte theory and the calculations involved in scaling determination and prediction. The learning objectives are to:

1. Describe the fundamental principles of the scaling phenomena
2. Relate theory of thermodynamics to scaling
3. Apply phase diagrams to the basic understanding of scaling
4. Perform scaling calculations and conclude on scenarios of process variables which control scaling

Wednesday – Stevns Klint (Peter Frykman):
The participants will learn about

1. The background for chalk sedimentation and processes involved
2. Physical properties of the chalk material

3. Fractures and effects on flow
4. What the K/T boundary tells about an important event in earth history

Thursday – Chemistry (Theis Sølling):
Chemistry is omnipresent also in the oil and gas section where the most complex mixture of chemicals imaginable – crude oil – is the product.

The objective is to give the participant and overview of the mechanisms behind the chemical processes that takes place in an oil reservoir and the tools for addressing their importance.

Friday – Petroleum mixtures and Enhance oil recovery (Alexander Shapiro):
At this day of the Summer school the participants will be introduced into the properties of petroleum fluids: what they consist of, how they behave under varying temperature and pressure, how their properties may be measured and modelled. In the second half of the day, an introduction to the modern methods of enhanced oil recovery will be given: How we can produce more oil by application of the chemicals, or gases, or by thermal methods.

Saturday – Geophysics and Geostatistics (Klaus Mosegaard):
In this introduction to geophysics and geostatistics we provide the background needed for combining complex geological information with geophysical data. From geophysics we have reflection seismic data, well log data, electromagnetic data etc., and from geological investigations we have obtained knowledge about rock types, layer sequences, folding and faulting. We will first introduce theory and methods for characterizing such information in a probabilistic form. Then we will present methods for integrating this information into one probabilistic model. All this will allow us to make predictions about geological conditions to be found at future borehole locations.

Our introduction to geophysics and geostatistics aims to provide the student with skills to describe available geo-information using statistical methods, understand and apply geostatistical simulation algorithms to describe and simulate geologically realistic structures, understand and quantify errors in geo-models, and to integrate geological and geophysical information.

Week 33 (Esbjerg)

AAU (Jens Bo Holm-Nielsen) and AU (Ole Rønø Clausen):
General course objectives

The course gives students from all fields of engineering an understanding of the technical, economic and environmental conditions governing the oil and gas industry in the North Sea. The complexity of the oil and gas industry and the need for a broad range of technical skills is illustrated and high tech solutions discussed. The participants will become familiar with the terminology of the various disciplines related to oil and gas production to a level that facilitates the specialization and project ideas for Master and Ph.D. levels. The course forms the basis for further studies in enhanced oil recovery technology at AAU, including thesis projects in all engineering fields. The jobs are mutual after finalizing the studies at the universities.

The course will in addition contain lectures on the North Sea evolution, introduction to the software used, and a case study in group. The case study is to be completed by a short report and a presentation of the results. The groups will be put together so that a variety of competences are present in all groups.

Learning objectives

A student who has met the objectives of the course will be able to:

- Learn and perform how to operate and tackle problems in the Oil and Gas industry. Meeting the big players at the Port of Esbjerg
- Perform a basic technological evaluation of production of oil and gas from a given discovery

- Present the technological options for production of oil and gas at different water depths
- Calculate the consequences of different production scenarios on the project economy
- Perform basic material and technology selection for oil and gas production from the given production conditions
- Optimize and automatize the production profile with new high tech solutions and online monitoring at the oil & gas platforms
- Evaluate the special economic, environmental and technological challenges and concerns related to offshore oil and gas production
- Use seismic interpretation software integrated with well log interpretations to characterize the structural geometry, formation of and potential of an oilfield from the North Sea.
- Characterize a HC reservoir using seismic and well log data.