DHRTC Summer School, Week 32 – Technical University of Denmark, Lyngby

Programme

	Sunday 05/08 Accommodation at Hotel Postgaarden	Monday 06/08 DTU (101, room S09) Introduction to the Danish mature fields	Tuesday 07/08 DTU (101, room S09) Scale and corrosion	Wednesday 08/08 Field trip, Stevns Klint Geology	Thursday 09/08 DTU (101, room S09) Chemistry in mature fields	Friday 10/08 DTU (101, room S01) Characterization of petroleum mixtures and EOR	Saturday 11/08 DTU (101, room S09) Geophysics	Sunday 12/08 Departure for Esbjerg
08.00				Departure for Stevns Klint. Meet up at the parking lot in front of building 101A.				
08.45		Welcome						
09.00-11.00		9.00-10.30: The improvement in oil and gas recovery from the Danish chalk fields is a story about technological evolution *Ole Jørgensen* 10.30-10.45: Coffee break 10.45-11.45: Today more than 50 years after start of production, DUC is chasing every bbl of oil in the most cost effective way possible *Lars Malcolm* 11.45-12.30: Advanced seismic analysis helps to locate bypassed oil and gas *Henriette Steinhart* *Alex Calvert*	9.00-9.15: Introduction to today's programme 9.15-10.45: General introduction to scale and corrosion and occurrence in the Danish North Sea Fields *Kitt Ravnkilde* 10.45-11.00: Coffee break		Chemistry in Mature Fields Wettability, interfacial tension and surface tension at the molecular level *Theis Sølling*	Petroleum mixtures: - Where are the fluids of interest stored? - Sampling the fluids - How does the reservoir fluid behave under pressure, temperature - Categories of the fluids *Klaus Potsch*	Introduction to Geophysics and Geostatistics *Klaus Mosegaard* *Thomas Hansen*	
11.00-12.30		Introduction to chemistry of ionic compounds in solution *Karen Feilberg*	Field trip to Stevns Klint *Peter Frykman*	Instrumentation and methods for studies of surface chemistry *Theis Sølling*	Petroleum mixtures: • Phase behaviour of the fluids • Production schemes • Production problems • Black oil approach • Compositional approach • Discussion: What do we need to know? *Klaus Potsch*	Geophysical modelling. Theory and exercises. *Klaus Mosegaard* *Thomas Hansen*		
12.30-13.30		Lunch (Cantina in 101)	Lunch (Cantina in 101)		Lunch (Cantina in 101)	Lunch (Cantina in 101)	Lunch (Cantina in 101)	

13.30-15.00		13.30-15.00: Total DK technology strategy supports mature fields excellence *Hans Henrik Kogsboll*	13.30-14.45: Corrosion mechanisms, experimental studies of corrosion types, monitoring and mitigation *Rajan Ambat* 14.45-15.00: Coffee break		Chemical traces and tracer tests. General mechanisms of production chemicals in mature fields *Theis Sølling* Presentation on Dynamics of Liquid-Liquid Interfaces: application to reservoir fluid production and surface treatment *Simon Ivar Andersen*	Enhanced Oil Recovery: • Why do we need EOR • What methods for EOR exists • EOR problems • Discussion: What do we need to know? *Alexander Shapiro*	Geostatistics. Theory and exercises. *Klaus Mosegaard* *Thomas Hansen*	
15.00-16.30		15.00-15.15: Coffee break 15.15-16.30: Improved oil and gas recovery through research based innovation at DHRTC *Morten Williang Jeppesen*	Barium and Strontium scales, carbonate scales, monotoring and mitigation (including exercises in Excel, remember your laptop) *Philip Fosbøl* 16.30: Wrap up and goodbye for today		Digital rock physics: Applications of CT scanning *Theis Sølling*	Enhanced Oil Recovery: Exercises/discussion Exercises with the thermodynamic software *Alexander Shapiro* *Klaus Potsch*	Putting it all together: Creating a reservoir model from geophysics and geostatistics. *Klaus Mosegaard* *Thomas Hansen*	

DHRTC Summer School, Week 33 – Aalborg University - Esbjerg

Programme

	Sunday 12/08 Arrival and accommodation at Danhostel Esbjerg	Monday 13/08 Aalborg University (Esbjerg) C1 – room 117	Tuesday 14/08 Aalborg University (Esbjerg) C1 – room 117 Monitoring and Automation in offshore Oil & Gas exploitation and production	Wednesday 15/08 Excursion Esbjerg Port	Thursday 16/08 Aalborg University (Esbjerg) C1 – room 117 Seismic acquisition, processing and interpretation. Petrophysical welllogs	Friday 17/08 Aalborg University (Esbjerg) C1 – room 117 Assignment in groups	Saturday 18/08 Aalborg University (Esbjerg) C1 – room 117 Assignment – Results and discussions
08.30				8.30-10.00: FINMUS (Fiskeri & Søfartsmuseet I Esbjerg). Mærsk sponsored Oil & Gas exhibition: ”50 years O&G sector” 10.30-12.00: SemcoMaritime – Large contracter in the O&G sector 12.00-12.30: Lunch at SemcoMaritime 12.30-14.00: Port of Esbjerg – from oil regs to large scale offshore wind projects 14.30-16.00: Total Engineering office in Esbjerg. Reconstruction of the Tyre Gas field and more.			
08.45		Welcome	Topside process systems (facilities and operations) Process monitoring and control (topside separation, slugging flows in pipelines and risers, gas-lift production wells, injection water treatment, produced water treatment) *Zhen Yu*				
09.00-10.45		1. General info of Oil and Gas EDU and R&D activities at AAU 2. Introduction on topside operations *Jens Bo Holm-Nielsen* *Jens Muff*			Reflection seismics: Theory , usability and pitfalls Reflectionseismics: How to do? *Ole Rønø Clausen* *NN*	Group work on assignment	Group work on assignment
11.00-12.30		- Overview of Topside Gas/Oil/Water Separation Units - Process Design of Separation Train - Issues on Oil/Water Separation *Marco Maschietti*	Emerging & advanced real-time monitoring and control techniques (Oil-in-Water, TSS, dissolved-oxygen, microscopy tech, fluorescence tech, tomography tech, MIMO control, MPC control, robust control) *Zhen Yu*		Geological interpretation and use of Petrophysical well logs *Ole Rønø Clausen* *NN*	Group work on assignment	Group work on assignment
12.30-13.30		Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)		Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)	Lunch (Cantina, building A, room 150)
13.30-15.00		Potential Applications of Membrane Technologies within Oil & Gas Production Units *Jens Muff*	Robotics for offshore OG applications (inline robot, ROVs and drones) *Petar Løhndorf*		Chalkfields in the North Sea – examples *Ole Rønø Clausen)* *NN*	Group work on assignment	Presentation and discussions of results
15.00-16.30		Production Chemistry – an overview of applications and challenges *Rudi Nielsen*	Lab testing pilot plants, advanced instruments and equipment *Simon Pedersen* *Stefan Jespersen*		Startup of case study assignment: Identify a chalk reservoir, and suggest well locations *Ole Rønø Clausen* *NN*	Group work on assignment	Presentation and discussions of results

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.