Reservoarfluider og Strømning

Reservoir Fluids and Flow
Course TPG 4145

NTNU / IPT
Autumn 2008

Curtis Hays Whitson
Professor

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Class Meetings:
IPT building room P1
Wednesday 12.15-14.00
Thursday 10.15-13.00

First meeting: Tuesday, Aug. 20, 2008
Last meeting: Wednesday, Nov. 20, 2008

Usually, no distinction is made between lectures (F) and problem sessions (Ø) – my approach to "problem-based" learning. Basically, any time a student has a question about a problem (øving), they should ask – during class, during class breaks, or after class. Every class meeting can begin with questions from students about previous class material and/or questions about class problems. When Curtis is away, the class meetings will usually be held by one of my PhD candidates, or possibly a problem session with student assistants.

Lectures (voice and presentation visuals) will be recorded and made available as video files, usually one week after the class meeting.

Exam: Dec. 8, 2008 (kl 9.00).

ItsLearning:
You must have access to ItsLearning at NTNU to take this course.

Required Reading List (Pensum):
1. Whitson, C.H. and Brule, M.R.: *Phase Behavior*, SPE monograph, selected chapters. Available at Tapir.
2. Whitson, C.H.: **Fluid Properties Data Book**, purchase at institute office.
3. Selected articles and notes, handed out in class.
4. e-notes (electronic, via internet address to be announced).

Electronic version of SPE Phase Behavior monograph will be made available, but any prints of the pdf files can NOT be used on the exam. You MUST use the book itself on the exam; you can write anything you like on the pages of the monograph book... so it's best to buy the book sooner than later.

Whitson Absences:
Absences may occur, but will be announced.

Student Assistants:
Håvard Heldal Lehne havarle@stud.ntnu.no
Espen Rørvik espenstr@stud.ntnu.no

Will assist with class problems and do most of the quiz/project grading.

Course Problems (Øvinger):
All problems must be handed in and given "passing" grade in order to have the right to take the exam. Due dates for each problem must be honored. If problems are handed in late, without written explanation (e.g. from a doctor), you may not be allowed to take the exam.

Don't cheat (copy from another student).

Two types of problems (øvinger) will be used in this course.

(1) In-class problems (quizzes), where the purpose is to assess the comprehension of students on course material previously covered (in this course or previous courses). The problems will be handed out at the beginning of class. A time limit will be given to solve the problem during class, and the problem must be handed in within the specified time. Some parts of the problem will be mandatory, and some parts may be optional.

If the in-class problem is not solved with a passing mark, or the problem is not solved at all (e.g. if the student doesn't come to class), then the problem in its entirety (mandatory and optional parts) must be delivered no later than after one week from when it was handed out.

(2) Several class problems and probably one small project will be assigned. These should be solved by programming and/or using a spreadsheet program such as Excel.

Complete solutions to problems and projects will not be provided. Most problems will be partially solved in class. Do not expect complete solutions to be handed out. You may ask questions about the problems and projects during problem sessions or during class. Ask until you are satisfied that you understand – it's your responsibility.

Turn in problem/project solutions *electronically* through ItsLearning no later than one week after they are handed out, unless stated otherwise on the problem/project itself, or on ItsLearning.

Problem Sessions (Øvingstimer):
Separate problem sessions may be held, as needed, but in general the students are expected to ask questions about the class problems during class meetings, class breaks, and after lecture. Any material discussed during class will be part of the course material (pensum).

Reading Material (pensum):
The reading material will not be lectured "verbatim", or in the order that it is presented in the book.

The required reading material should be used *as is necessary to understand the lectured material*. It is your job to identify what information in the reading material helps *you* understand the lecture material. This requires you to "look through" the reading material as the course progresses. Ask if you are uncertain about whether written material has been covered in lecture.

Class Preparation:
It is expected that students come prepared to class. Required preparation includes, as a minimum, all previous material covered in class. This will be tested periodically with in-class quizzes.

Course Level:
Independent of the students attending this course, the curriculum (information to be learned) is fixed. If 4th-year students, MSc students, dr.ing. students, or anyone else should elect to take this course, we will cover the same material – the requirements of 3rd-year petroleum engineering students. If you are uncertain if a particular subject is part of the curriculum, ask.

Language:
The lectures and discussions will, for the most part, be in English. If a Norwegian student wants to ask questions in Norwegian or they want an explanation repeated in Norwegian, just ask *på norsk*. I speak and understand Norwegian – but I consider my lectures better and more understandable in English. However, all meetings that I have with Norwegian students – at my office, during breaks, or after class meetings – are usually in Norwegian.

Should the use of English in this course be a problem, please contact me directly to discuss the problem. Else, ask the class representatives to bring up the subject in their meetings with me (as soon as possible).

COURSE MATERIAL

Topics

Gas PVT Basics *(e-note, SPEPBM Ch. 2&3)*
Gas Rate Equation – Darcy Flow *(e-note)*
Gas Material Balance *(e-note)*

Components and Chemistry *(SPEPBM Ch. 2)*
Phase Behavior and General PVT *(SPEPBM Ch. 2)*
Equilibrium Concepts*(SPEPBM Ch. 2)*
Equilibrium Calculations – isothermal flash & saturation pressure
(a few sections from SPEPBM Ch. 3-4)
Separator Flash Calculations *(section from SPEPBM Ch. 6)*

PVT Experiments *(SPEPBM Ch. 6)*

Black-Oil PVT Model *(SPEPBM Ch. 7)*

Equation of State Basics *(SPEPBM Ch. 4)*

Comprehensive Questions and Answers (Q&A)

Note:
SPEPBM - SPE (Society of Petroleum Engineers) Phase Behavior Monograph 20