Syllabus

PNGE 332: Petroleum Properties and Phase behavior

West Virginia University, spring 2019

Lecture: Tuesday 18:00-19:50 (ESB-E 251)

LAB: Friday 16:00-17:50 (ESB-E G11)

Instructor

Dr. Ebrahim Fathi
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Office Hours: T F 13:00-14:00 or by appointment
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Laboratory Supervisor

Dr. Ebrahim Fathi

Teaching Assistant
TA: 'Joshua Dietz' jrdietz@mix.wvu.edu
Office Hours: M W R 11:00-13:00 or by appointment

Prerequisites
You **must** have the following prerequisites to be eligible to attend in this course

PNGE 200 - Introduction to Petroleum Engineering;
ENGL 102 Composition and Rhetoric
CHEM 116 Fundamentals of Chemistry

Course Objectives:
It is critical to be able to predict the properties of the reservoir fluids accurately in all areas of petroleum engineering. Substantial progress in our understanding of the physical properties of fluids has occurred during the last few decades. In this class we will explore these properties and fluid phase behavior through algebraic and numerical applications of thermodynamic theory, equations of state and empirical correlations. I will provide you with Matlab codes that explain step by step how these correlations and charts are created and how you can use programming for numerical applications of the theories we will discuss in the class. We also study the surface separator calculations for different reservoir fluids.
Expected Learning:
Outcomes: Upon successful completion of this course:

1. Student will learn the behavior of systems consisting of pure and multiple components under different pressure, temperature and volume conditions
2. Student will be able to recognize different reservoir fluids based on their properties (Black oil, Volatile oil, retrograde gas, wet gas and dry gas)
3. Student will learn how to use the field data to check results of laboratory fluid studies or the accuracy of correlations for the given reservoir
4. Student will be able to determine the properties of typical black oil fluids using five major laboratory procedures (i.e., Composition measurement, Flash vaporization, Differential vaporization, Separator tests, Viscosity measurement)
5. Student will learn to use the best available correlations to estimate the physical properties of interest (bubble point pressure, Gas oil ratio, etc.)
6. Student will learn how to perform separator calculations so that the optimum operating conditions for production is determined
7. Student can estimate the properties of the reservoir fluid both at the reservoir and surface conditions and also optimize production for a given two-stage surface separation unit
8. Student will learn how to handle large quantities of water with significantly varying compositions at a minimum cost in the oil fields
9. Student will have gained experience in working as a team member in their phase behavior laboratory group
10. Student will increase their proficiency in technical communication by writing individual laboratory report for each laboratory session and one team project

Textbooks
The required textbook is available in the WVU bookstore and Book exchange. Additional readings will be distributed in class or made available on the course website. Since the material in this course builds on itself, it is important that you keep up with the readings as they are assigned.
Required: William D. McCain, Jr., The Properties of Petroleum Fluids, 2nd edition (PennWell Publishing Company, 1990).

Course Outline
The following course outline is subject to change, and the number of weeks spent on each topic is a rough estimate.

1. Introduction
2. Phase Behavior (2 sessions)
3. Equations of State (2 session)
4. Multi-component Phase Diagrams (1 session)
5. Properties of Dry Gases (1 session)
6. Properties of Black Oils (3 sessions)
7. Gas-liquid Equilibria (1 session)
8. Surface Separator Calculations (1 session)
9. Equilibrium-Ratio Correlations (1 session)
10. Properties of Oilfield Water and Gas Hydrates (1 session)
11. Phase behavior and Phase coexistence in shale gas reservoirs (1 session)

Details on the assignments will be given as we progress in the class. This schedule leaves one lecture session at the end of the semester for the overall discussion of the semester and the upcoming final exam.

Laboratory
In the laboratory sessions you will apply the concepts discussed in lecture. The exercises introduced in the lab session will be completed and submitted as part of the student evaluation to the Laboratory TA.
We will be meeting several weeks throughout the semester. Schedules of the laboratory sessions will be given during the lecture. You should make an extra effort to attend the laboratory sessions every week, as make-up sessions will not be offered.

Student Evaluation (Marking Scheme)
Homework Assignments 20%
Laboratory Reports 20%
Midterm Exam (In-class) 30%
Final Exam (In-class) 30%
Midterm Exam Date: There will be an in-class midterm exam Tuesday 18:00, March 5, 2019
Final Exam Date: There will be an in-class final exam Tuesday 18:00, April 23, 2019.

Grade Assignment:
100 – 96	A+	95 – 90	A
89 – 87	A-	86 – 84	B+
83 – 80	B	79 – 77	B-
76 – 74	C+	73 – 70	C
69 – 65	C-	64 – 60	D
59 – 0	F		

Grading Questions:
If you believe that a problem set or exam question was graded incorrectly, you are welcome to raise the issue with TA's or me. If you simply don't like your grade and come to argue with any of us for more points, you will probably find that there are better uses of your time.
TA's will grade the assignment sets and laboratory reports. If you have a question about how your problem set was graded, please speak with him. I will not change an assignment grade that has not first been discussed with TA's. If you have a grading question on midterm exam, please see me during my office hours or set up a separate appointment.

Late Work: No late assignments will be accepted. If you think you may have difficulty completing an assignment on time, please ask TA for an extension as early as possible. *No extensions will be granted fewer than 48 hours before an assignment is due.* We will try to accommodate busy schedules, but not poor planning. The assignments are due at the **beginning** of regular lecture time, no exceptions.

Class Procedure
Attendance Policy: Consistent with WVU guidelines, students absent from regularly scheduled examinations because of authorized University activities will have the opportunity to take them at an alternate time. Make-up exams for absences due to any other reason will be at the discretion of the instructor.

Attendance in laboratory and lecture sessions are mandatory, however if you cannot attend in class you need to inform instructor prior to the class. More than three unauthorized absents results in %5 deduction from your final grade, if you miss more than 5 sessions you will lose %10 from your final grade and more than 7 unauthorized absents results in failing the course with grade F.

Lectures in class will deal with the subject matter of the textbook and will provide supplementary information. Exams will cover the information provided during the lecture.

Texting or surfing (e.g. Facebook) in class is disrespectful and is therefore not allowed. All the cellphones must be on silent mode.

All the homeworks and lab reports MUST be typed and turned in through ecampus turnitin.

Social Justice Statement:

"The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu."

Academic Integrity

Incidents of student misconduct or academic dishonesty will be handled promptly and appropriately in accordance with the WVU Student Conduct Code and Discipline Procedure. The case will be referred to the Office of Student Conduct. Violations may lead to dismissal from the Statler College and expulsion from the University.

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code https://studentconduct.wvu.edu/policies-and-procedures . Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

You also need to go to the http://www.libraries.wvu.edu/instruction/plagiarism/ and pass the test and report your passing grade to the instructor.

Calculators may be allowed for use during the exams, depending on the material to be covered. Explicit guidance will be provided before the exam. In any case, use of electronic devices such as PDAs or programmable calculators for storing or communicating material that would not otherwise be available to you during the exam is strictly prohibited, and will result in a failing grade for the course and referral for academic discipline.