PTE 507 Fall 2016
Engineering and Economic Evaluations of Subsurface Reservoirs

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Office Hours: Thursday 10:00 am – 12:00 noon, HED 314
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Class Meeting Time: Thursday 6:40 – 9:20 pm, OHE 122
TA Office Hours: TBA

Course Description and Objectives:

This course is intended for current and future petroleum engineers to understand the economic side of oil and gas production. The economic output of reservoir development will be evaluated based on reservoir characteristics, investment strategy, oil price forecasts, and local tax laws. We will first introduce basic economic concepts and calculations such as discount, gross revenue, cost, tax, and net present value. Next, we will highlight forecast techniques of oil and gas production. Then we will combine economics and reservoir performance to evaluate the worthiness of one or several hydrocarbon deposits, or an individual production well. Different investment strategies will be explored to achieve the maximum economic outcome. Possible under, over, and optimal investment scenarios will be examined and discussed.

More advanced production and reservoir engineering topics will also be introduced. Horizontal wells and their productivity, cost, and benefit will be evaluated. Water coning will be studied and critical production rate will be estimated. Finally, we'll address the economic impact of uncertainties and risks commonly encountered in the oil industry, such as reserve size and oil price. Later in the semester a project will be assigned in which you will perform a Monte-Carlo simulation to evaluate the worthiness of a hypothetical oil/gas reservoir with numerous uncertainties.

Course Outline:

1. Aug 25: Outline the objectives of this class; introduction and reviews of basic petroleum engineering concepts
2. Sep 1: Economic concept and calculation methods, time value of money, continuous and discrete discount methods
3. Sep 8: Tax, royalty, CAPEX, OPEX and investment amortization, depreciation
4. Sep 15: Cash flow model for simple oil production and price profiles
5. Sep 22: Economic evaluation shale gas wells, production forecast and economic value
6. Sep 29: Investment criteria and strategies, under-, over- and optimal investment scenarios
7. Oct 6: **Midterm exam**, 6:40 pm – 9:10 pm
8. Oct 13: More oil and gas production forecast methods, empirical and simulation, short and long terms
9. Oct 20: Uncertainties, probability and distributions, reserve estimation methods
10. Oct 27: Horizontal wells, productivity, cost and benefit evaluation
11. Nov 3: The Monte-Carlo simulation method and its application in the oil industry. Project assignment, each student will have a unique hypothetic reservoir to evaluate.
12. Nov 10: Water coning, critical rate, water production, economic evaluation
13. Nov 17: Presentation and discussion of the Monte-Carlo project, five minutes per student.
14. Nov 24: (Thanksgiving Day, no class)
15. Dec 1: Strategic planning, production of multiple oil reservoirs with water injection and other surface facilities
16. Dec 8: **Final exam**, 7-9 pm

Final Grade Calculation:
Homework 20%, Midterm Exam 30%, Final Exam 35%, Project 10%, Attendance & Class Participation 5%

100-95.1%	95.0 - 90.1%	90-85.1%	85-80.1%	80-75.1%	75-70.1%	70-65.1%	65 - 60.1%	60-0%
A	A-	B+	B	B-	C+	C	C-	F

Homework will be assigned at the end of each lecture, and the assignment is due at the beginning of the next lecture. Completing homework on time is an important part of the learning process. Students can have group studies and discussions outside of class. However, each student must complete his or her homework and project assignments independently. All homework and project will be graded, and the results will be tabulated and used in determining the final grade.

Other requirements for this course:

1. It is important to attend all lectures. Please check the class schedule and arrange your work and travel plans accordingly.
2. The midterm and final exam dates cannot be changed. Missing one exam will likely result in a failing grade.
3. DEN students can type their homework with a word processor, or scan handwritten pages with an optical scanner. Convert the typed or scanned homework to a PDF file and submit the PDF file electronically to the DEN office before the deadline. Photos of homework are *not* acceptable because they are often hard to read.
4. On-campus students are encouraged to submit their typed or handwritten homework in PDF format. A dropbox will be created for each homework on the Desire2Learn website. Students must upload the homework before the due time. Do ***not*** send pdf files through emails. Students who have difficulty converting homework to PDF files may submit homework on paper (8.5 by 11 inches), single-sided only.
5. Computer codes must be submitted in electronic form if requested.
6. All homework assignments must be submitted on time. If an assignment is turned in late, 10% credit will be deducted for each day late. If a student has an emergency and cannot turn in homework on time, please contact the instructor in advance for late homework submission. Keep in mind that chronic late homework submissions can result in a failing grade.
7. Matlab and Microsoft Excel will be used extensively for homework assignments. Matlab can be installed on a PC. Please Google-search “USC Matlab” for installation instructions.
8. Extensive computer programming is required to complete the project and some of the homework assignments. Matlab is recommended but other programming languages such as C, C++ and VB are also acceptable.

Books and References:

1. Dake, L.P. *Fundamentals of Reservoir Engineering*, Elsevier, 1978 (or other prints)
2. Mian, M.A. *Project Economics and Decision Analysis, Vol 1: Deterministic Models, Vol 2: Probabilistic Models*, PennWell, 2011
3. Mooney, C.Z. *Monte Carlo Simulation*, Sage Publication, 1997
4. SPE papers to be assigned