

Methods in Petroleum Geology (Petrel) (GEOL 4191/5191-01)

Instructors: Po Chen (pchen@uwyo.edu)

Classroom: ESB 1006

Class: MWF 10am-10:50am

Office hours: MW (TBD) or by appointment

Grading: S/U

Prerequisite: Petroleum Geology (GEOL 4190/5190)

Overview

It has been widely recognized that more oil and gas could be extracted from reservoirs if the geology of the reservoir was understood. Throughout the years, petroleum geology has grown into a quantitative, multi-faceted discipline that requires a vast array of skill and knowledge sets. With the advent of modern computing technology and visualization equipment, large amounts of multi-disciplinary data can be integrated and interpreted more effectively. In this course, we will demonstrate techniques and methodologies that are widely used in modern petroleum geology using the software PETREL, an integrated workflow tool that facilitates geoscientists to think critically and creatively about reservoir modeling. This course is a lab-based course and key concepts are demonstrated through extensive hands-on exercises.

Course Outline

1. Overview of PETREL
 - a. What is PETREL?
 - b. Why use PETREL?
 - c. The user interface
 - d. Online manual and help
 - e. A simple demo that demonstrates different modules.

2. Well Data
 - a. Introduction to drilling
 - b. Cuttings log
 - c. Core
 - d. Conventional logs
 - e. Unconventional logs
 - f. Importing well data into PETREL
 - g. Editing log data in PETREL
 - h. Visualizing well logs in PETREL

3. Basic Sedimentary Rock Properties
 - a. Classification and properties of sediments and sedimentary rocks
 - b. Sedimentary structures and their significance
 - c. Geological time scale
 - e. Determining the time frame of rock formation

- f. Biostratigraphy
 - g. Depositional environments
 - h. Walter's law and succession of sedimentary facies
 - i. Stratigraphic modeling in PETREL
 - j. Well correlation process in PETREL
 - k. Building a well section in PETREL
 - l. Working with wells in a well section in PETREL
 - m. Tools for well correlation in PETREL
 - n. Working with well logs data in PETREL
 - o. Well section manipulation in PETREL
4. Seismic Interpretation
- a. Reflection seismology and subsurface imaging
 - b. 2D seismic
 - c. 3D seismic
 - d. 4D seismic
 - e. Other seismic imaging techniques
 - f. Display seismic data in PETREL
 - g. Computing synthetic seismograms in PETREL
 - h. Horizon interpretation in PETREL
 - i. Fault interpretation in PETREL
 - j. Seismic attribute display in PETREL
 - k. Feature (volume) extraction in PETREL
5. Structural Modeling and Grid Building
- a. Building fault models in PETREL
 - b. Pillar gridding in PETREL
 - c. Building horizons in PETREL
 - d. Depth conversion in PETREL
 - e. Make zones and layers in PETREL
 - f. Preliminaries of property modeling in PETREL
 - g. Volume calculations in PETREL
 - h. Well design in Petrel

Grading Policy:

In this course, emphasis is placed on the homework problems and final exam/project due to the time-consuming nature of these assignments. The final grades will be given based on your homework and term project (or exams). The appropriate percentage is shown:

Homework	50%
Mid-term Exam	25%
Final Exam	25%

Note that each homework exam has a standalone grade of 100 points. When determining the final grade, these will be normalized reflecting the percentage distribution above. The final letter grade is given based on the numerical grade:

S U

>60 < 60

Textbook (recommended):

Elements of Petroleum Geology, by Richard Selley, 1998

Tools:

The majority of the exercises and homework problems can be solved using Petrel.

Attendance Policy

Each student is expected to attend the lectures to fulfill the academic requirements. For participation in a University-sponsored activity or for unusual circumstances (personal hardship), an authorized absence may be issued to the student by the Director of Student Life or the Director's authorized representative. If a student produces the proof of absence, a makeup session can be arranged with the instructor.

<http://uwadmnweb.uwyo.edu/legal/Uniregs/ur713.htm>

Course requirements:

This class is composed of three lectures per week. Students are expected to independently work out the class exercises, homework problems, lab projects, and exams. The instructors have developed a set of PowerPoint presentations as well as lecture notes for this class and will periodically post them in the course website. The lecture notes however do not contain formula proofs, equation derivations and solutions to class exercises, so class attendance and participation is key to learning the materials.

Questions & Answers

Questions for the instructor: (1) during lecture; (2) office hour.

Policy on Late homework, make-up exams, grade of incomplete

Policy for this class:

- Unless otherwise stated, each homework is expected to be handed in to the instructor in the beginning of the class one week after the homework is assigned; If not handed in on time, each day it's delayed, 10 points will be taken out of the total grade (100) of that homework until no points remain.
- Unless otherwise stated, each homework is expected to be completed and handed in the beginning of the next lecture.

If a student can provide valid proofs of absence, the above rules do not apply. Within a reasonable time (1 week), the student is expected to hand in the late homework to the instructor or arrange with the instructor on a make-up exam. It is the student's

responsibility to contact the instructor to make arrangement in a timely manner and in advance if at all possible, failing to do so will result in the forfeiture of the relevant points.

Grade of incomplete: During the semester, if a student has suffered severe problems (e.g., physical or mental incapacitation) and cannot complete the course as a result, he/she may be issued an “I” (incomplete) grade. Best to be avoided to reduce the frustrations and confusions for both the student and the instructor. The UW regulation on this is long and complex: <http://uwadmnweb.uwyo.edu/legal/Uniregs/ur720.htm>

Academic dishonesty

As defined by UW, academic dishonesty is:

An act attempted or performed which misrepresents one's involvement in an academic task in any way, or permits another student to misrepresent the latter's involvement in an academic task by assisting the misrepresentation.

UW has a time-tested procedure to judge such cases, and serious penalties may be assessed.

So, do not cheat and do not help others cheat! In this class, if a student is caught cheating, he or she will not only lose the full point of the assignment/test, but may also be assigned a “F” for the course.

Plagiarism is considered a form of cheating. Both students will lose the full points on the particular homework or lab assignments. However, when writing papers, a student may cite other's work, but proper attribution must be given.

Concerning homework/exams styles

Four points must be emphasized: (1) For problems involving equations, if appropriate, provide a complete analysis rather than a single number. (2) Be professional in your presentations. If applicable, write down the unit for your results and round off the final number to 1 or 2 decimal points. (3) You can discuss the problems with fellow students, but complete your assignments by yourself. Copying other's work is considered cheating and no points will be given. (4) Hand in the homework on time. Finally, please keep all course materials (notes, exercises, homework/exams/labs) to yourself and do not share them with future students. They must, as you have, work to earn the credit.

Disability Statement

If you have a physical, learning, sensory or psychological disability and require accommodations, please let me know as soon as possible. You will need to register with, and provide documentation of your disability to University Disability Support Services (UDSS) in SEO, room 330 Knight Hall.

Disclaimer

The syllabus is subject to changes as deemed necessary by the instructor. If a significant change were to be made, all students will be informed of it and given appropriate reasons for such a change.